# BCI 3303 Oximeter

## Service Manual


BCI International
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## Appendix Appendix-1

# Chapter 1: Warranty & Service Information

## Proprietary Notice

 Its' purpose is to provide the user with adequately detailed documentation to efficiently install, operate, maintain and order spare parts for the device supplied. Every effort has been made to keep the information contained in this document current and accurate as of the date of publication or revision. However, no guarantee is given or implied that the document is error free or that it is accurate regarding any specification.

## Limited Warranty

BCI International warrants each new device to be free from defects in workmanship and materials under normal use and service for a period of two (2) years from the date of shipment, and reusable probes for a period of one (1) year from shipment (domestic sales only). BCI International's sole obligation under this warranty will be to repair or replace, at its option, products that prove to be defective during the warranty period. The foregoing shall be the sole warranty remedy. Except as set forth herein, seller makes no warranties, either expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. No warranty is provided if the products are modified without the express written consent of BCI International, and seller shall not be liable in any event for incidental or consequential damage. This warranty is not assignable.

## Loaner Device

BCI International will for the period of warranty make available at no charge, loaner devices if, in BCI International's opinion, the repair of the customer's device would require an unreasonable period of time.

## Service Support

Repairs of BCI International's devices under warranty must be made at authorized repair centers. If the device needs repair, contact BCI International's service department to request a customer service report number (CSR). When calling, have the device's model and serial number ready.

**NOTE! Shipments received without a CSR number will be returned to sender.**

If you need to ship the device, pack the device and accessories carefully to prevent shipping damage. All accessories should accompany the device.

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# Chapter 2: Warnings, Cautions, & Notes

A *warning* tells you about something that could hurt the patient.

A *caution* tells you about something that could damage the monitor.

A *note* tells you other important information.

## ⚠ Warnings

**WARNING! Federal law (USA) restricts the use or sale of this device by, or on the order of a physician.**

**WARNING! Do not use this device in the presence of flammable anesthetics.**

**WARNING! Do not use this device in the presence of magnetic resonance imaging (MR or MRI) equipment.**

**WARNING: This device must be used in conjunction with clinical signs and symptoms. This device is only intended to be an adjunct in patient assessment.**

**WARNING! Reposition the probe at least once every 4 hours to allow the patient's skin to respire.**

**WARNING! When attaching probes with Microfoam®[1] tape, do not stretch the tape or attach the tape too tightly. Tape applied too tightly may cause inaccurate readings and blisters on the patient's skin (lack of skin respiration, not heat, causes the blisters).**

## ⚠ Cautions

**CAUTION! The monitor is equipped with an internal rechargeable battery. Do not attempt to remove or replace the internal rechargeable battery. Refer servicing to an authorized repair center.**

**CAUTION! Do not autoclave, ethylene oxide sterilize, or immerse the probes in liquid.**

**CAUTION! This device is intended for use by persons trained in professional health care. The operator must be thoroughly familiar with the information in this manual before using the device.**

**CAUTION! Connect only the printer cable specifically intended for use with this device (see *Optional Supplies and Accessories).***

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[1] Microfoam® is a registered trademark of the 3M Company.

## Notes

**NOTE! Operation of this device may be adversely affected in the presence of strong electromagnetic sources, such as electrosurgery equipment.**

**NOTE! Operation of this device may be adversely affected in the presence of computed tomograph (CT) equipment.**

**NOTE! Use only $SpO_2$ probes supplied with, or specifically intended for use with, this device.**

**NOTE! $SpO_2$ measurements may be adversely affected in the presence of high ambient light. Shield the probe area (with a surgical towel, for example) if necessary.**

**NOTE! Dyes introduced into the bloodstream, such as methylene blue, indocyanine green, indigo carmine, and fluorescein, may adversely affect the accuracy of the $SpO_2$ reading.**

**NOTE! Any condition that restricts blood flow, such as use of a blood pressure cuff or extremes in systemic vascular resistance, may cause an inability to determine accurate pulse rate and $SpO_2$ readings.**

**NOTE! Remove fingernail polish or false fingernails before applying $SpO_2$ probes. Fingernail polish or false fingernails may cause inaccurate $SpO_2$ readings.**

# Chapter 3: About This Manual

This manual contains circuit descriptions, voltage and waveform test points, detailed parts lists, and circuit diagrams for the oximeter and the charging base. It is intended for persons trained in service, maintenance, and repair of modern medical equipment. Thorough knowledge of this equipment's operation is required before attempting to repair this equipment.

The remainder of the manual is divided into these sections:

- **Oximeter Circuit Description.** Contains circuit descriptions, voltage test points, and waveform test points for the oximeter and display board.
- **Parts Lists & Circuit Diagrams.** Contains detailed parts lists and circuit diagrams for the oximeter and charging base.

# Chapter 4: Oximeter Circuit Description

## Functional Structure

The functional structure of the oximeter is shown in drawing no. 72042S1. The oximeter consists of the main board, the display board, the key label, and the battery:

- The oximeter board contains the battery charger, power supplies, the on/off control logic, the microprocessor, and the data acquisition circuitry.
- The display board contains the 7-segment displays, the led bar graph, the indicator lights, LED driver chip, and the speaker circuitry. The display board connects to the main board through an eight-conductor cable.
- The key label contains the front panel touch keys and two LED's.

## Battery Charger

### General Description

The wall mount charger has an unregulated 24 V DC output that comes into the main board at J5. Transorb D8 prevents electrostatic discharges from entering the system. The charger circuit converts the input voltage to charge current with a step down buck converter made up of Q17, D7, L2, and U28. The actual current control is maintained by the MAX713 (U27) by monitoring the voltage generated across R87,R93. This voltage is regulated to 250 mV during fast charge and 31 mV during trickle charge. This results in a charge current of 312 mA during fast charge and a 39 mA trickle charge. The power used by the system for the processor, display board etc., is returned to ground rather than -V BATT. This results in the battery charge current being constant regardless of the system load. The batteries charge just as fast with the unit powered up as when its turned off. The product uses 850 mA batteries and so the charge current is 312/850+0.36C and will take about 3-4 hours to perform a full charge.

The MAX713 is powered by dropping the input voltage to 5 V through the resistors R79/R80. The chip has an internal 5 V zener between the V+pin and ground. As stated earlier the MAX713 monitors the voltage at -V BATT to regulate the charge current. The DRV pin (U27-14) is the control output and is used to adjust the input control voltage of the pulse width modulator made up of U28A and B. The MAX 713 has a maximum rating of 16 V on the DRV pin and so D11, R83, Q19 make up a small 12 V regulated supply to run the PWM circuitry. U28B is wired as a free running 220Khz astable multivibrator. The output (U28-9) is fed to U28A to control the duty cycle of the signal driving the FET (Q17). C87 is used to AC couple the drive signal to the FET so that in the event of a failure of U28 the FET is protected from a full on condition.

U27-8 goes low whenever the MAX713 is in fast charge mode. The rating on this line is 12 V maximum so D12 is used to protect the chip from damage. When fast charge is active U27.8 turns on Q18 which lights up the yellow LED on the key label. The green LED on the key label is lit whenever the input power is plugged in and the charger is supplying current.

### Battery Protection

D9 prevents discharge of the battery when input power is disconnected. The MAX713 has an internal mechanism for isolation from the battery when no power is available.

The MAX713 also provides thermal protection of the battery. The battery pack contains a thermal fuse set at 70°C and a 10K thermistor with a tempco of -4.41%/°C. The thermistor is connected between pins 2 and 3 of the battery pack. The MAX713 has a 2.00 V reference at U27-16 which is divided down to 535.5 mV at TP29. This voltage is used with an internal comparator at U27-6 (TLO) to prevent battery damage caused by fast charging a cold battery. Another comparator at U27-5 is used to stop fast charging the battery if it gets too hot. Battery temperatures below 10°C will cause the battery to be trickle charged until warm. If the battery gets above 47°C fast charge ceases.

## Oximeter On/Off Control

- When the oximeter is off and the ON key is pressed U13-5 is shorted to ground, which causes flip-flop output U13-3 to go low and output U13-6 to go high,which in turn enables the power supply converter U29.

There are two ways the oximeter can be turned off:

- When the OFF/STBY key is pressed.
- When the Power Fault Output signal (/PFO), generated by the power monitor/watchdog chip U25, goes low.

When either the OFF/STBY key is pressed or the signal /PFO goes low:

- Flop output U13-3 goes high and output U13-6 goes low, turning off the power supply converter U29.

## System Power Supply

A low power linear 5 V regulator (U30) is used to supply continuous power to the RAM, when the unit is turned off. This V-RAM supply also provides power to the ON/OFF circuitry.

The main power supply is built around U-29, a pulse width modulated switch mode buck converter. The transformer T1 is used as a power inductor in the buck converter generating +5 VDC, and as a fly back transformer to generate low power -5 VDC.

## Microprocessor Circuit

A standard microprocessor core is formed by microprocessor U14, PROM U18, and RAM U19. Crystal X11, C53, and C54 form the oscillator circuit. The microprocessor's PHI output at U14-71 is one-half of X11's frequency.

### Reset Circuit

Watchdog timer chip U25 performs three functions:

- RESET is generated by U25 if VCC is less than +4.4 VDC.
- NMI (non-maskable interrupt to microprocessor) is generated by U25 if the signal /WDT is not strobed within 1.6 seconds.
- /PFO (power fail output) is generated by U25 if the input PFI at U25-4 becomes less than 1.25 VDC. /PFO turns off the oximeter through U13B, Q10, and Q15.

Gates U13C and U13D disable access to RAM chip U19 while RESET is active.

### Memory and I/O Decoding

Demultiplexer U17B decodes A16, A17, and ME to allocate memory space. The following chart shows the memory address allocation:

| FROM | TO | ENABLED DEVICE |
|---|---|---|
| 00000H | 0FFFFH | PROM U18. |
| 10000H | 1FFFFH | RAM U19. |
| 20000H | 2FFFFH | A/D U21 read and chip select strobe. |
| 30000H | 3FFFFH | A/D U21 start conversion strobe. |

Demultiplexer U17A decodes A6, A7, and IOE to allocate I/O space. The following chart shows the I/O address allocation:

| FROM | TO | SIGNAL OR ENABLED DEVICE |
|---|---|---|
| 00H | 3FH | not used (64180 microprocessor internal I/O address space). |
| 40H | 7FH | DAC-LD load strobe to U7. |
| 80H | BFH | /KEYRD strobe to U22 and LATCH gate strobe to U16. |
| C0H | FFH | DSP-LD strobe to display board U1 and /WDT strobe to U25. |

## Addressable Latch

Addressable latch U16 decodes A0-A3 and provides 9 outputs for controlling the oximeter board's circuitry. The following chart shows the output addresses for LATCH (80-8FH) and the functions for each output address:

| OUTPUT ADDRESS | SIGNAL AND DESCRIPTION |
|---|---|
| 80H<br>81H | CAP-GND shunt inactive.<br>CAP-GND shunt active. |
| 82H<br>83H | RED-DRV (red LED) off.<br>RED-DRV (red LED) on. |
| 84H<br>85H | IR-DRV (infrared LED) off.<br>IR-DRV (infrared LED) on. |
| 86H<br><br>87H | RST-INT (integrator reset) off.<br>INTGRAT (integrator) on.<br><br>RST-INT (integrator reset) on.<br>INTGRAT (integrator) off. |
| **OUTPUT ADDRESS** | **SIGNAL AND DESCRIPTION** |
| 88H<br>89H | MUX-A = 0<br>MUX-A = 1 |
| 8AH<br>8BH | MUX-B = 0<br>MUX-B = 1 |
| 8CH<br>8DH | LOUDCTL = speaker soft.<br>LOUDCTL = speaker loud. |
| 8EH<br>8FH | QUIET = on.<br>QUIET = off. |

### Synchronous Serial Port

The microprocessor's synchronous serial port TXS/CKS is used to send data to the adjustable gain voltage to current converter U7 and to send data to the display driver chip U1. U7's data is latched with the I/O strobe DAC-LD; display driver chip U1's data is latched with the I/O strobe DSP-LD.

### Asynchronous Serial Port

The microprocessor has two internal asynchronous serial ports: TXA0/RXA0 and TXA1/RXA1. TXA0/RXA0 is used for manufacturer test and OEM interface applications. TXA1/RXA1 is used for sending printer data to the printer through RS-232 converter U26. If the oximeter probe is connected, logical low state of signal PRB - DET disables U26. When the probe is unplugged, communication is enabled through pins 4 and 8 of patient probe connector.

TXA0 at U17-48 is buffered by U15D and routed to JP2. RXA0 is buffered by U15E and routed to U14-49.

### Speaker Output

Microprocessor output A18 (TOUT) is configured as a timer output and controls the tone of the pulse beep speaker.

### Keypad Interface

Gate U22 (/KEYRD, input address 80H) provides 8 inputs for reading the oximeter's keys and checking the state of the PRB-DET signal. The following chart shows the possible conditions for each input:

| ADDRESS 80H INPUT BIT | SIGNAL AND DESCRIPTION |
|---|---|
| D0 | 0 = PRB-DET not true (probe not connected to oximeter).<br>1 = PRB-DET true (probe connected to oximeter). |
| D1 | 0 = Spotck not true (I.D./CLEAR key not pressed).<br>1 = Spotcktrue (I.D./CLEAR key pressed). |
| D2 | 0 = Spotck not true (I.D./CLEAR key not pressed).<br>1 = Spotcktrue (I.D./CLEAR key pressed). |
| D3 | 0 = Up not true (UP ARROW key not pressed).<br>1 = Up true (UP ARROW key pressed). |
| D4 | 0 = Down not true (DOWN ARROW key not pressed).<br>1 = Down true (DOWN ARROW key pressed). |
| D5 | 0 = BeepV not true (PULSE VOL key not pressed).<br>1 = BeepV true (PULSE VOL key pressed). |
| D6 | 0 = AlmVol not true (ALARM VOL key not pressed).<br>1 = AlmVol true (ALARM VOL key pressed). |
| D7 | 0 = AlmSil not true (ALARM SILENCE key not pressed).<br>1 = AlmSil true (ALARM SILENCE key pressed). |

## Analog Demultiplexer

Analog multiplexer U6 routes one of four possible analog inputs to a single output. The signals MUX-A and MUX-B from addressable latch U16 control which input gets routed to U6's output as shown in the following chart: (For the addresses of these signals, see earlier in this section *Addressable Latch*.)

| SIGNAL | MUX-B | MUX-A | U6 INPUT |
|---|---|---|---|
| A-Ground | 0 | 0 | X0 |
| V-REF | 0 | 1 | X1 |
| V-A | 1 | 0 | X2 |
| V-BATT | 1 | 1 | X3 |

The output of U6 is buffered by U2B then amplified ($A_V$ = -5) by U2A. The output of U2A (SIGNAL at TP9) is routed to the input of the ADC.

## A/D Converter

A/D converter (ADC) U21 is configured as a 12-bit ADC. The ADC's input voltage comes from SIGNAL at TP9. The ADC's reference voltage output, 3.00 VDC, is used by the analog circuitry. The following sequence describes an ADC conversion cycle:

- Write to memory address 30000H (/ADCST) to pulse low U21-27. This pulses the ADC's /CONVST (start conversion) input to begin the conversion cycle.
- Wait 10 µsec, then read memory address 20000H for the low order 8 bits of the 12-bit conversion. Read memory address 20001H for the high order 4 bits of the 12-bit conversion.

## LED Drive

The red LED drive circuit is formed by Q4, Q2, Q5, and their associated discrete components. When the signal RED-DRV is pulsed high, Q4 turns on, which turns on Q2 and Q5. While Q2 is on, current flows from ANA+5V through Q2, through J1-3 to the anode of the red LED, through J1-2 from the cathode of the red LED, through Q5, through R22, to ground. Q5 provides a constant current sink by D2 at Q5-base and R22 at Q5-emitter.

The infrared (IR) LED drive circuit is formed by Q3, Q1, Q6, and their associated discrete components. When the signal IR-DRV is pulsed high, Q3 turns on, which turns on Q1 and Q6. While Q1 is on, current flows from ANA+5V through Q1, through J1-2 to the anode of the IR LED, through J1-3 from the cathode of the IR LED, through Q6, through R27, to ground. Q6 provides a constant current sink by D1 at Q6-base and R27 at Q6-emitter.

## Signal Processing

The differential transconductance amplifier formed by U8 and U9 converts the photodetector's current output to a voltage at TP7 (V-AMB). Unity gain amplifier U3A offsets the signal at TP7 so the signal baseline is at 3 VDC. This allows a wider signal range for the negative-going pulses at TP7.

V-AMB is passed through blocking capacitor C14 to remove the signal's DC component, then the signal is buffered by U3B. The output of U3B is routed to adjustable gain, voltage to current converter U7. The microprocessor determines the appropriate gain for the signal, then loads this value into U7 with the signals TXS, CKS, and DAC-LD. The output of U7 is routed to current to voltage converter U4. (Note that U1B "zeros" the output of U4 for the time while no signal of interest is present at U4; this prevents U4 from saturating.)

U4's output is integrated and filtered by U1A, and is routed to amplifier U2A. U2B passes V-REF to TP8 and to the input of U2A to sum V-REF with the signal from U1A. The output of U2A (SIGNAL at TP9) is routed to the ADC for measurement.

## Display Board

The display board contains the LED display driver chip, the 7-segment displays, the LED bar graph, and the speaker circuit. The display board is interfaced to the oximeter board through an 8-conductor flexible strip cable.

### Display Circuitry

The display driver chip U1 receives synchronous data from the microprocessor's TXS and CKS lines. The data is loaded with the I/O strobe DSP-LD.

U1 generates electrical noise that might cause inaccurate measurements from the ADC. For this reason, U1 is turned off for 2 msec out of 8 msec (during the data acquisition time). The signal BLANK turns off U1.

U1 controls the 7-segment displays and the LED bar graph according to the data it receives from the TXS serial channel. The brightness of the displays is controlled by the I-SET input at U1-18. The display's brightness is adjusted by allowing or preventing current to flow through R2 and D4, D5, or D6.

### Speaker Circuitry

Speaker circuitry consists of pulse frequency modulator built around U2, and current switch Q1.

U2A creates a high frequency (approximately 50 kHz.) oscillator with variable duty cycle and period. Duty cycle and period are controlled by the signal LOUDCTL. If LOUDCIL is at logic "zero", then U2C gate increases discharge current through C4, which makes the total period shorter. C4 charging current, stays constant and is defined by resistor R3. That is why changing the period affects the duty cycle of the oscillator, too.

Oscillator is strobbed by TONE signal.

The output of the oscillator controls a current switch Q1. Changing duty cycle on this switch changes the amount of power supplied to the 8 ohm speaker, and, in turn, volume of the sound.

## Signal Dictionary

This section lists in alphabetical order the signal names used on the schematics. The signal's origin, destination, and purpose are described.

### Oximeter Board

| SIGNAL | DESCRIPTION |
|---|---|
| A0-A17 | A0 through A17 are the microprocessor's address lines. A0-A17 are used to address the RAM, PROM, and I/O ports. |
| A18 | Microprocessor output A18 (TOUT) is configured as a timer output and controls the tone of the optional pulse beep speaker. |
| ANA+5 | The +5 volt power supply VCC is filtered to produce ANA+5. ANA+5 powers the analog circuitry. |
| ANA-5 | The -5 volt power supply is filtered to produce ANA-5. ANA-5 powers the analog circuitry. |
| VBAT+ | Connects to 9.6-volt rechargeable battery "+" terminal. |
| VBAT- | Connects to 9.6-volt rechargeable battery "-" terminal. |
| CAP-GND | CAP-GND originates at addressable latch U16 and is routed to analog switch U5. When CAP-GND is on, the blocking capacitor C14 is shunted to ground; this action sets the baseline of V-AMB to ground before data acquisition. |
| CKS | CKS is the microprocessor's high-speed, synchronous serial output clock signal. CKS is routed to two serial clocked devices: the display board's driver U1 and the adjustable gain, voltage to current converter U7. |
| D0-D7 | D0 through D7 are the microprocessor's data lines. The data lines are routed to RAM, PROM, and ADC U21. |

| SIGNAL | DESCRIPTION |
|---|---|
| DAC-LD | DAC-LD originates at decoder U17A. DAC-LD is routed to the serial clocked, adjustable gain, voltage to current converter U7. When DAC-LD is strobed, U7 loads data from TXS. |
| DSP-LD | DSP-LD originates at decoder U17A. DSP-LD is routed to the display board's driver U1. When DSP-LD is strobed, U1 (on the display board) loads data from TXS. |
| FLTR+5 | The ANA+5 power supply is filtered to produce FLTR+5. The FLTR+5 supply powers the photodetector's first stage amplifier. |
| FLTR-5 | The ANA-5 power supply is filtered to produce FLTR-5. The FLTR-5 supply powers the photodetector's first stage amplifier. |
| INTGRAT | INTGRAT originates at addressable latch U16 and is routed to analog switch U5. When INTGRAT is on, the signal at TP6 is integrated by U1A. When INTGRAT is off, the signal at TP6 is not allowed to pass to the integrator, and the integrator is reset by the action of RST-INT. |
| IR-DRV | IR-DRV originates at addressable latch U16 and is routed to the infrared LED drive circuit at Q3. When IR-DRV is pulsed on, the probe's infrared LED is pulsed on. |
| /KEYRD | Strobe to U22 (input address 80H) that loads the state of the key switches and the PRB-DET signal onto the data bus. |
| LATCH | LATCH originates at decoder U17A and is routed to addressable latch U16. LATCH loads and latches the state of A0 for the Q output specified by A1 through A3. |
| ME | ME is the microprocessor's memory enable output. ME is routed to decoder U17B to enable memory decoding. |
| MUX-A | MUX-A originates at addressable latch U16 and is routed to analog demultiplexer U6 "A" input. |
| MUX-B | MUX-B originates at addressable latch U16 and is routed to analog demultiplexer U6 "B" input. |
| OFF-INT | OFF-INT originates at the on/off flip-flop formed by U13A and U13B and is routed to the microprocessor's INT1 (interrupt 1) input. When the OFF/STBY key is pressed, OFF-INT goes low, generating an interrupt request at the microprocessor. The microprocessor responds to the interrupt by performing several "housekeeping" tasks before the oximeter turns off. |
| OFFS-NULL | OFFS-NULL originates at U14-45 (microprocessor RTS0 output) and is routed to analog switch U5. When OFFS-NULL is on (between data acquisition periods), the output of U4 is zeroed by U1B. This prevents U4 from saturating during data acquisition. |
| ON | ON originates at the ON key and is routed to the on/off control circuit. ON is pulled to V-RAM through R29. While the ON key is pressed, the signal ON goes low. This turns on Q10 and Q15, which turns on the voltage to the regulator chips. |

| SIGNAL | DESCRIPTION |
|---|---|
| /PFO | /PFO (power fail output) is generated by U25 if the input PFI at U25-4 becomes less than 1.25 VDC. /PFO turns off the oximeter through U13B, Q10, and Q15. |
| PRB-DET | PRB-DET originates at the probe connector and is routed to input gate U22-2. The probe's connector has pins 1 and 6 shorted, so pin 1 (PRB-DET) is pulled to ground while the probe is connected. The voltage level at PRB-DET is read at input port 80H, bit 0 to determine if the probe is connected (logic level 0) or if the probe is not connected (logic level 1). |
| /Quiet | /Quiet originates at addressable latch U16; /Quiet is routed to the display board's driver U1. /Quiet turns the displays during the data acquisition time (2 msec out of 8 msec total). |
| RD | RD is the microprocessor's read signal. It is routed to PROM and RAM. |
| RED-DRV | RED-DRV originates at addressable latch U16 and is routed to the red LED drive circuit at Q11. When RED-DRV is pulsed on, the probe's red LED is pulsed on. |
| RST-INT | RST-INT originates at addressable latch U16 and is routed to analog switch U5. When RST-INT is on, the integrator output at U1A is reset. When RST-INT is off, the signal at TP6 is integrated by U1A. |
| RXA0 | Routed to JP2 for use with manufacturer and OEM interface applications. |
| RXA1 | Input to IR-transistor Q13; this is the data from the printer. |
| SIGNAL | SIGNAL originates at TP9 and is routed to ADC U21's VIN input. Depending on the state of the analog demultiplexer U6, SIGNAL represents either GROUND, V-REF, V-BATT, or the probe signal. |
| STBY | SBTY originates at the OFF/STBY key and is routed to the on/off control circuit. STBY is pulled to V-RAM through R34. While the OFF/STBY key is pressed, the signal STBY goes low. This turns off Q10 and Q15, which turns off the voltage to the regulator chips. OFF-INT goes low, too. |
| TXA0 | Routed to JP2 for use with manufacturer and OEM interface applications. |
| TXA1 | Output to IR-diode Q10; this is data that is sent to the printer. |
| TXS | TXS is the microprocessor's high-speed, synchronous serial output transmitted data signal. TXS is routed to two serial clocked devices: the display board's driver U1 and the adjustable gain, voltage to current converter U7. |

| SIGNAL | DESCRIPTION |
|---|---|
| V-AMB | V-AMB (TP7) originates at the output of amplifier U9. V-AMB is routed to blocking capacitor C14. The DC level of V-AMB represents the fixed offset (3.00 VDC) minus the amount of light sensed by the photodetector. V-AMB is the same signal as V-A; V-A is routed to analog demultiplexer U6. V-A is measured by the ADC then tested to determine if U9 is saturated. |
| V-RAM | The V-RAM supply powers the CMOS RAM chip and the oximeter on/off control circuit while the monitor is off and on. |
| V-REF | V-REF originates at the REFOUT pin of ADC U21 and is routed to two circuits: the fixed-offset driver formed by U3A and the analog demultiplexer U6. |
| VCC | VCC is the regulated +5 VDC supply generated by +5 volt power supply regulator chip U26 and its discrete components. |
| VDD | Same as VCC. |
| VSS | Digital ground. |
| WR | WR is the microprocessor's write signal. It is routed to RAM. |

## Display Board

| SIGNAL | DESCRIPTION |
|---|---|
| /BLANK | Same as oximeter board /QUIET. |
| CKS | Same as oximeter board CKS. |
| DIG1-DIG5 | DIG1 through DIG8 originate at display driver U1 and are routed to the common cathode pins of the seven-segment LED displays DS1 through DS10. DIG1 is pulsed low to turn on the segments at DS1 represented by Sa-Sg. This is repeated for DIG2 through DIG8; then DIG1 is pulsed again. The entire cycle is controlled by display driver U1 as it receives data from the microprocessor's CKS signal. |
| DSP+ | DSP+ originates at the output of the +5 volt power supply regulator chip U26. DSP+ powers the display driver U1. |
| DSP-LD | Same as oximeter board DSP-LD. |
| LOUDCTL | Output from addressable latch U16 on the oximeter board. When logic level 0, speaker volume is low. When logic level 1, speaker volume is high. |
| Sa-Sg | Sa-Sg originate at display driver U1 and are routed to the seven-segment displays and the led bar graph. The state of Sa through Sg determine which display or bar graph segments light when the corresponding DIG signal is strobed. |
| TONE | Output from microprocessor's TOUT pin 31. Controls the tone of the speaker. |
| TXS | Same as oximeter board TXS. |

## Test Equipment and Tools Required

To diagnose and repair the full extent of possible malfunctions on the oximeter and display board, you'll need the following test equipment and tools:

- DMM, volts/ohms/amps, with 10 MΩ input impedance or greater
- Oscilloscope, 50 MHz, with 10 MΩ input impedance or greater
- AC Power Supply
- Small Phillips screwdriver
- Small flat blade screwdriver
- Needle nose pliers
- Diagonal cutters
- Clip leads
- Low-power microscope or magnifying glass
- Soldering iron and solder
- Solder wick or solder remover

## Voltage Test Points

Unless otherwise noted, all voltages are measured with respect to ground at TP-16.

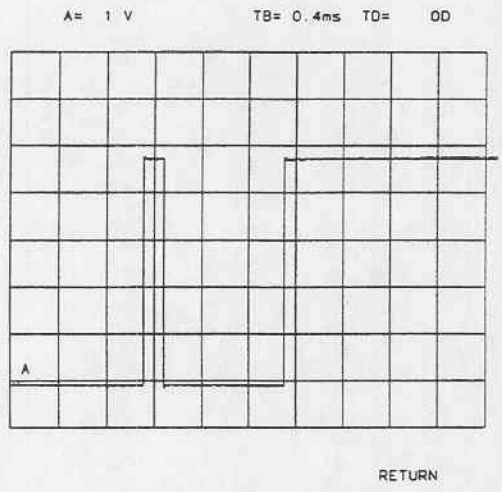
| LOCATION | CONDITION | NOMINAL AND RANGE |
|---|---|---|
| TP14 | Oximeter on. | 5 VDC, ± 0.25 VDC |
| ANA+5 | Same as TP14. | Same as TP14. |
| FLTR+5 | Same as TP14. | Same as TP14. |
| TP15 | Oximeter on. | -4.8 VDC to -6.2 VDC |
| ANA-5 | Same as TP15. | Same as TP15. |
| FLTR-5 | Same as TP15. | Same as TP15. |
| V-REF | Oximeter on. | 3.00 VDC |
| V-RAM | Oximeter on. | 5VDC, ± 0.25 VDC. |
| U14-71 | Oximeter on. | 6.144 MHz, 50% duty cycle. |
| TP26 | AC Power Supply on. | 12.0 ± 1.0V |
| TP27 | AC Power Supply on. | 9.0 to 14.0V depends on the state of the battery charge. |
| TP28 | AC Power Supply on. | 250 ± 50 mV unless in trickle charge mode. |

## Waveform Test Points

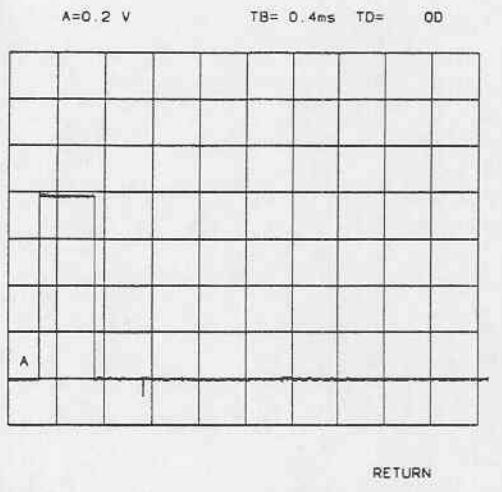
The following oscilloscope screens show typical waveforms from the probe detector's amplifier and data acquisition circuits. Unless otherwise noted:

- The waveforms are measured with respect to ground at P1-2.
- The oscilloscope is triggered on TP11, falling edge.
- The waveforms are measured with the finger probe attached to the oximeter with finger or piece of paper in probe.

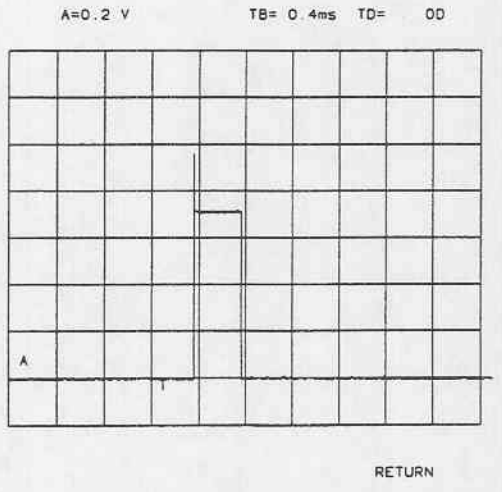
TP11:



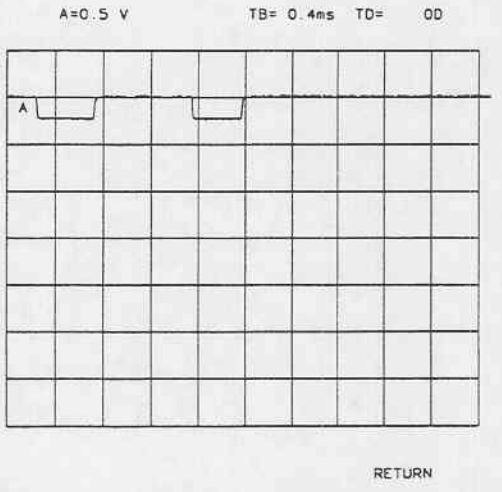

TP20:



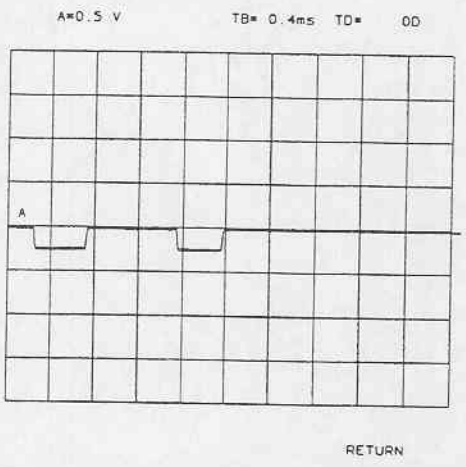

TP21:



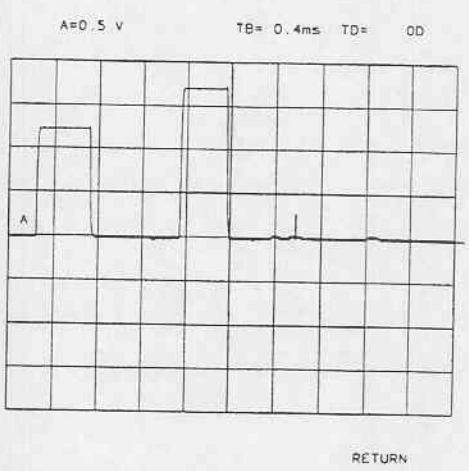

TP7:



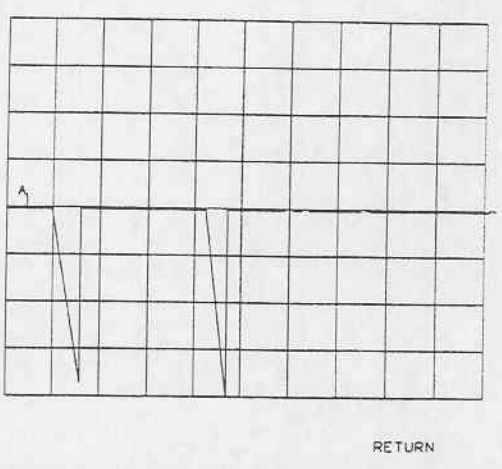
TP18:



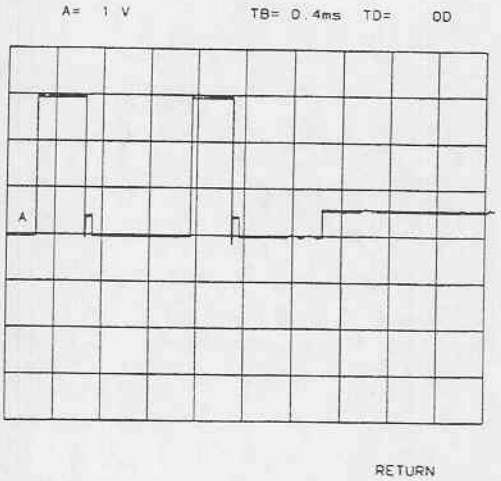

TP6:



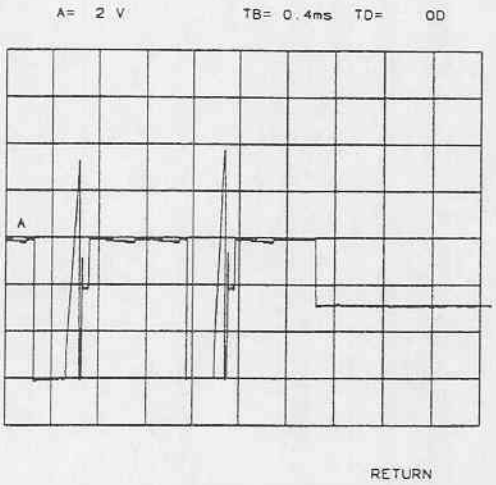

TP17:




TP8:




TP9:



# Appendix

## Parts Lists, Assembly Drawings, and Schematics

| LINE | LEV | LINE/REF | PART NO/DESC | REV | QUANTITY | UM | MAC |
|---|---|---|---|---|---|---|---|
| 0 | 0 | | 72042A1<br>F/ASM NEWOX 3 BCI | 5 | 1.000 | EA | M |
| 1 | _1 | / | 20511B1<br>BARRIER INSULATING BOTTOM 1.10 X 1.20 | 1 | 1.000 | EA | B P |
| 2 | _1 | / | 20511B2<br>BARRIER INSULATING TOP 1.10 X 1.20 | 1 | 1.000 | EA | B P |
| 3 | _1 | / | 20613B1<br>CHARGER 8200 3303 105-125V 60HZ | 1 | 1.000 | EA | B P |
| 4 | _1 | 0 | PACK2<br>PACKING MATL NEWOX2 3302/3303/8200 | | 1.000 | EA | B P |
| 5 | _1 | 1 | 72041B1<br>CASE WITH SCREENED WINDOW NEWOX3 | 2 | 1.000 | EA | B P |
| 6 | _1 | 3 | 72040B1<br>PWB A/T MAIN NEWOX3 | 16 | 1.000 | EA | B P |
| 7 | _1 | 4 | 71054B1<br>PWB A/T DISPLAY NEWOX2 /3303 | 13 | 1.000 | EA | B P |
| 8 | _1 | 7 | 20605B3<br>BATTERY PACK NIMH | 0 | 1.000 | EA | B P |
| 9 | _1 | 8 | 12026B3<br>SCREW TAPPING 4 X 1/4 TYPE B PHILLIPS PAN HD | 0 | 4.000 | EA | B P |
| 10 | _1 | 9 | 70420B2<br>WASHER RUBBER .693 ID X .830 OD | | 1.000 | EA | B P |
| 11 | _1 | 10 | 71178B1<br>SPEAKER LOW-IMPEDANCE NEWOX2 | 0 | 1.000 | EA | B P |
| 12 | _1 | 13 | 57217B1<br>ADHSV NON-COROSIVE DC738 *SH* | | .000 | EA | B P |
| 13 | _1 | 14 | 71087B2<br>LABEL QUICK USER REFERENCE GUIDE | 0 | 1.000 | EA | B P |
| 14 | _1 | 15 | 71012B5<br>LABEL INFORMATIVE 3302/3303 BCI | 2 | 1.000 | EA | B P |
| 15 | _1 | 16 | 71011B56<br>ID LABEL 3303 NEWOX3 | 0 | 1.000 | EA | B P |
| 16 | _1 | 17 | 71058B5<br>LENS KEYPAD NEWOX3 W/LED | 5 | 1.000 | EA | B P |
| 17 | _1 | 19 | 12028B1<br>SCREW TAPPING #4 X 7/8 TYPE BA PHILLIPS PAN | 0 | 5.000 | EA | B P |
| 18 | _1 | 20 | 70868C8<br>INSULATOR 3302 DISPLAY BOARD | 1 | 1.000 | EA | M P |

| LINE | LEV | LINE/REF | PART NO/DESC | REV | QUANTITY | UM | MAC |
|---|---|---|---|---|---|---|---|
| 19 | _1 | 21 | 56239B1<br>TAPE DOUBLE-SIDED FOAM 1/2"W X 1/32"T | 0 | .168 | FT | B P |
| 20 | _1 | 22 | 20442B6<br>WIRE STRANDED 26AWG VIOLET 300V | 0 | .292 | FT | B P |
| 21 | _1 | 23 | 71059B1<br>LED W/SILKSCREEN SENSOR | 4 | 1.000 | EA | B P |
| 22 | _1 | 24 | 71059B2<br>LED W/SILKSCREEN BATTERY SYMBOL | 4 | 1.000 | EA | B P |
| 23 | _1 | 25 | 71059B3<br>LED W/SILKSCREEN BELL | 4 | 1.000 | EA | B P |
| 24 | _1 | 26 | 20606B1<br>BRKT BATT SUPPORT 8200/3303 | 2 | 1.000 | EA | B P |
| 25 | _1 | 27 | 20621B1<br>LABEL BATT PACK (MADE BY MFG.) CAPNOCHECK | 0 | 1.000 | EA | M P |
| 26 | _1 | 28 | 58362B1<br>LABEL CE MARK | 1 | 1.000 | EA | B P |
| 27 | _1 | 29 | 31062B2<br>LABEL CSA TUV CHARGER 8210 8212 | 0 | 1.000 | EA | B P |

| DESCRIPTION | QTY | DESIGNATION(S) | MANUFACTURER'S PART NO. |
|---|---|---|---|
| 22pF,50V,5% | 3 | C1,C26,C27 | 1206 COG SMT, Any |
| .1uF,50V,10% | 60 | C2,C3,C4,C5,C6,C7,C8,C9, C10,C11,C12,C19,C20,C21, C22,C23,C24,C25,C30,C34, C35,C36,C37,C38,C40,C41, C44,C45,C52,C55,C56,C57, C58,C59,C60,C63,C64,C65, C66,C67,C68,C69,C71,C72, C74,C75,C76,C77,C81,C82, C85,C86,C87,C90,C91,C95, C97,C102,C103,C104 | 1206 X7R SMT, Any |
| 10pF,50V,10% | 3 | C13,C53,C54 | 1206 COG SMT, Any |
| .1uF,POLY | 1 | C14 | ECQ-V1H104JZ3 Panasonic |
| 1500pF,POLY | 1 | C15 | QYA2A152KTP Nichicon |
| .39uF,POLY | 1 | C16 | ECQ-V1H394JZ Panasonic |
| 120pF,50V,5% | 2 | C18,C17 | 1206 COG SMT, Any |
| .001uF,50V,10% | 2 | C28,C29 | 1206 X7R SMT, Any |
| 470uF,6.3V | 1 | C31 | 477RSS6R3M Illinois Cap |
| 10uF,TANT,16V | 7 | C32,C33,C48,C50,C61,C62,C98 | 6032 TANT SMT, Any |
| 100uF,6.3V | 2 | C42,C43 | 107RSS6R3M Illinois Cap. |
| 680uF,6.3V | 1 | C46 | ECEA0JFQ681 Panasonic |
| 1uF,TANT,16V | 7 | C47,C51,C78,C79,C80,C88,C89 | 3216 SMT, Any |
| 220pF,+/-5% | 3 | C49,C96,C101 | 1206 COG SMT, Any |
| 100uF,16V | 2 | C70,C92 | ECEA1CFS101 Panasonic |
| .01uF,100V,10% | 4 | C73,C93,C94,C100 | 1206 X7R SMT, Any |
| 56pF,50V,+/-5% | 2 | C83,C84 | 1206 COG SMT, Any |
| 33uF,35V | 1 | C99 | ECEA1VU330 Panasonic |
| BAV99LT1 | 6 | D1,D2,D3,D6,D13,D14 | Motorola or any |
| MURD620CT | 2 | D5,D7 | MURD610CT , MURD615CT or MURD620CT Motorola, D-PAK |
| SMBJ36A (Preferred) Or SMBG36A | 1 | D8 | General Semiconductor |
| CMR1-02 | 2 | D9,D10 | SMD Central Semiconductor Corp. |
| DL5242B | 2 | D11,D12 | Diodes, Inc, Liteon or any |
| BLM21B222S | 12 | FB1,FB2,FB3,FB4,FB5,FB6, FB9,FB10, | Murata Erie |
| BLM41A01PT | | FB7,FB8,FB11,FB12 | Murata Erie |
| 8 POS SIP SOCKET | 1 | JP1 | 744-8 T&B Ansley |
| 3 POS SIL HEADER | 1 | JP2 | AMP 103321-3 or similar |
| DB9-F | 1 | J1 | 747905-2 AMP |
| 12 POS SIL HEADER | 1 | J6 | AMP 1-103321-2 |
| 3 POS SIL LOCKING HEADER | 1 | J7 | 22-23-2031 Molex |
| POWERJACK | 1 | J8 | DJ005B LZR |
| FILTER COM MODE 15uH | 1 | L1 | 500-1579 B.H. Elec. |
| 100uH,2.0A | 1 | L2 | HL-KI210L Hurricane Lab |
| MMBTA55LT1 | 3 | Q1,Q2,Q18 | Any, or MMBTA56LT1 |
| MMBT3904LT1 | 2 | Q3,Q4 | Any |
| MMBTA05LT1 | 3 | Q5,Q6,Q19 | Any, or MMBTA06LT1 |
| 2N7002 | 1 | Q16 | Any |

ORIGINAL

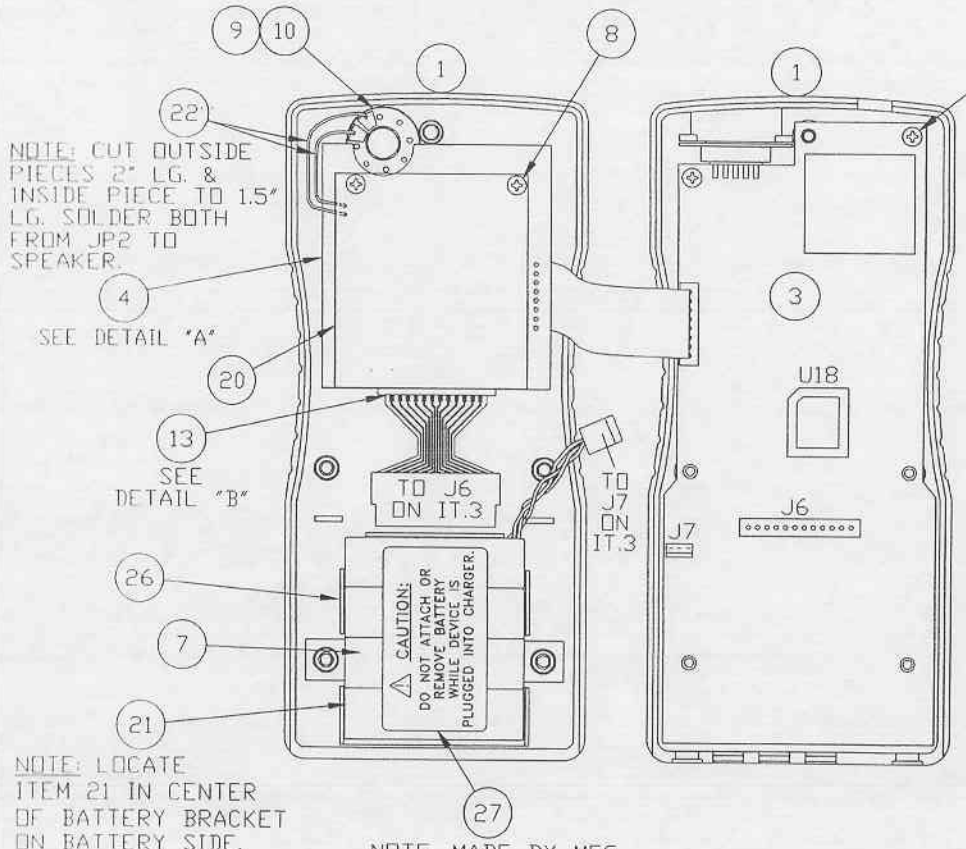
| DESCRIPTION | QTY | DESIGNATION(S) | MANUFACTURER'S PART NO. |
|---|---|---|---|
| MTD2955 | 1 | Q17 | Motorola, D-PAK, or SMD10P05 or SMD10P06 Siliconix, or IRFR9020, or IRFR9022, or IRFR9024 or IRFR9025 International Rectifier, or IRFR9024, or IRFR9020 Diodes Inc. |
| 732K,.125W,1%,100PPM | 6 | R1,R38,R51,R71,R97,R47 | 1206 SMT, Any |
| 100K,1%,.125W,100PPM | 15 | R2,R8,R9,R28,R29,R34,R64, R65,R66,R67,R68,R69,R70, R90,R10 | 1206 SMT, Any |
| 20K,1%,.125W,100PPM | 5 | R3,R4,R11,R88,R89 | 1206 SMT, Any |
| 56.2K,1%,.125W,100PPM | 3 | R7,R5,R98 | 1206 SMT, Any |
| 10K,1%,.125W,100PPM | 8 | R6,R14,R15,R18,R19,R49, R86,R96 | 1206 SMT, Any |
| 47,.125W,5%,200PPM | 3 | R12,R13,R74 | 1206 SMT, Any |
| 45.3K,1%,.125W,100PPM | 8 | R17,R16, R45,R48,R52,R53,R54,R73 | 1206 SMT, Any |
| 2.49K,1%,.125W,100PPM | 10 | R20,R21,R26,R56,R57,R58, R59,R60,R62,R63 | 1206 SMT, Any |
| 5.1,.125W,5%,200PPM | 1 | R22 | 1206 SMT, Any |
| 270,.125W,5%,200PPM | 2 | R24,R61 | 1206 SMT, Any |
| 560,.125W,5%,200PPM | 2 | R25,R75 | 1206 SMT, Any |
| 10,.125W,5%,200PPM | 1 | R27 | 1206 SMT, Any |
| 100,.125W,5%,200PPM | 2 | R72,R91 | 1206 SMT, Any |
| 53.6K,1%,.125W,100PPM | 2 | R76,R77 | 1206 SMT, Any |
| 19.6K,1%,.125W,100PPM | 1 | R78 | 1206 SMT, Any |
| 3.65K,1%,.125W,100PPM | 12 | R79,R80,R81,R82,R83,R84, R85,R94,R95,R23,R30,R31 | 1206 SMT, Any |
| 1.6,.125W,5%,200PPM | 2 | R87,R93 | 1206 SMT, Any |
| 1K,1%,.125W,100PPM | 1 | R92 | 1206 SMT, Any |
| TESTPOINT | 14 | TP6,TP7,TP8,TP9,TP11, TP14,TP15,TP16,TP17,TP18, TP19,TP20,TP21,TP24 | TP-105-01-02 Components Corp. |
| 100uH,2.0A with auxilary winding | 1 | T1 | BCI 72046B1 |
| 10K @ 25C,-4.41%/C | 2 | T2,T3 | KC003T Keystone |
| TLC272CD | 4 | U1,U2,U3,U8 | Texas Instruments |
| AD711JR or MC34081BD | 2 | U9,U4 | Analog Devices Motorola |
| DG308ACY | 1 | U5 | Siliconix, Harris or Maxim |
| MC14051BD | 1 | U6 | Motorola |
| MAX543BCWE | 1 | U7 or U7X | Maxim or DAC8043FS Analog Devices, or 72032B1 BCI |

| DESCRIPTION | QTY | DESIGNATION(S) | MANUFACTURER'S PART NO. |
|---|---|---|---|
| MC74HC132AD | 1 | U13 | Motorola or any |
| HD64180RF8X | 1 | U14 | Hitachi |
| MC74HC14AD | 1 | U15 | Motorola or any |
| MC74HC259D | 1 | U16 | Motorola or any |
| MC74HC139AD | 1 | U17 | Motorola or any |
| 27C256-20/L | 1 | U18 | Microchip |
| SOCKET 821973-1 (or Equiv.) | 1 | | AMP |
| HM62256LFP-15T (or Faster) | 1 | U19 | Hitachi |
| AD7870JP | 1 | U21 | Analog Device |
| MC74HC540DW | 1 | U22 | Motorola or any |
| MAX706CSA or | 1 | U25 | Maxim |
| ADM706AR | | | Analog Devices |
| LT1180ACS | 1 | U26 | Linear Technology |
| MAX713CSE | 1 | U27 | Maxim |
| ICL7556ISD | 1 | U28 | Maxim |
| MAX738CWE | 1 | U29 | Maxim |
| LT1121CST-5 | 1 | U30 | Linear Technology |
| CRYSTAL 12.288MHZ | 1 | X11 | EPSON CA-301 12.288M-C |
| FAB ARTWORK | 1 | 400 | BCI 72039B1 |
| STANDOFF | 5 | 401 | Unicorp SU269-4A-16 |
| COVER SHIELD | 1 | 402 (SEE NOTE 3) | BCI 71017B1 |
| SOFTWARE ASM | 1 | 403 (SEE NOTE 4) | BCI 71073A1 |
| BARRIER INS. 2 MIL | *1 | 404 | BCI 20511B1 |
| BARRIER INS. 11MIL | *1 | 405 | BCI 20511B2 |
| GLUE, HOT MELT | A/R | 406 | BCI 58326B1 |
| SILICONE | A/R | 407 | Any |
| SEALANT (BIWAX 84123) | A/R | 408 | BCI 31098B1 or |
| EPIC PREG 0127 | | | BCI 31098B2 |

* - INDICATES SUPPLIED BY BCI

| Qty | Ref. | Part | Manuf. P.N. | Vendor |
|---|---|---|---|---|
| 2 | C1,C5 | .1uF,50v,+80,-20%,Z5U | Cer, Axial, Any | Any |
| 1 | C3 | 1000uF,6.3V,Low Imp. | ECAOJFQ102 PANASONIC | Any |
| 1 | C4 | 470pF,63VDC,COG,+/-5% | Any | Any |
| 1 | C6 | 10uF,6.3V,TANT | Any | Any |
| 1 | C7 | .01uF,50v,+80,-20%,Z5U | Cer, Axial,Any | Any |
| 3 | DS1,DS2,DS3 | HDSP-E103 | HEWLETT PACKARD | Any |
| 3 | DS4,DS5,DS6 | HDSP-A103 | HEWLETT PACKARD | Any |
| 1 | DS7 | HLCP-J100 | HEWLETT PACKARD | Any |
| 3 | DS8,DS9, DS10 | .100 8 POS SOCKET | T & B ANSLEY 744-8 | Any |
| 6 | D4,D5,D6, D8,D9,D10 | 1N4148 | Any | Any |
| 1 | JP1 | HEADER 8X.100 | 8POS FLEXIBLE FLAT CABLE FSP22.5A-8 THOMAS & BETTS | |
| 1 | Q1 | SI9953DY | SILICONIX | Any |
| 1 | R1 | 27K,1/4W,5%,CF | Any | Any |
| 1 | R2 | 20K,1/4W,5%,CF | Any | Any |
| 1 | R3 | 100K,1/4W,1%,MF | Any | Any |
| 1 | R4 | 30.1K,1/4W,1%,MF | Any | Any |
| 1 | R5 | 5.62K,1/4W,1%,MF | Any | Any |
| 1 | R6 | 10 Ohm,1/4W,5% | Any | Any |
| 1 | U1 | MAX7219CNG | MAXIM | Any |
| 1 | U2 | MC74HC132AN | MOTOROLA | Any |
| 1 | 400 | FAB BOARD | 71053B1(REV.D FILMS/REV.2 DWG) | |

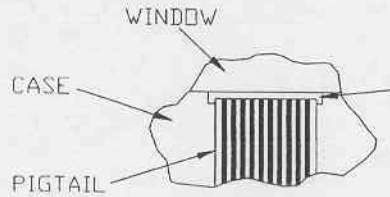
ORIGINAL





DETAIL "A"

NOTE: BEFORE INSTALLING ITEM 4, INSERT LEDS IN TERMINAL BLOCKS AT BOTTOM CENTER OF BOARD AS SHOWN.




NOTE: HOLD PIGTAIL AWAY FROM WINDOW AND FILL SLOT WITH ITEM 13.

DETAIL "B"

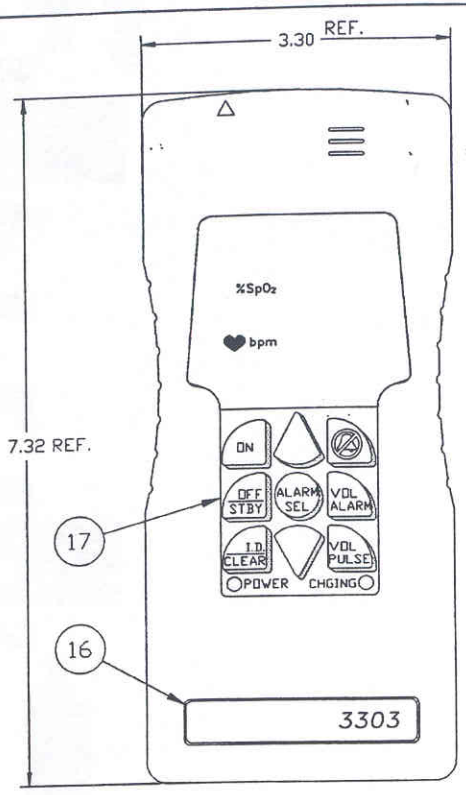
| DRWG NO: 72042A1 | |
|---|---|
| REV. | DESCRIPTION |
| 1 | SEE SHEET 2 C/N2500 SDP 4-4-96 |
| 2 | SEE SHEET 2 C/N2530 SDP5/17/96 |
| 3 | SEE SHEET 2 C/N 3024 KMK 4-4-97 |
| 4 | SENSOR & BATT SYMBOL WAS PROBE & BATT. REMOVED ITEM 6 ON DWG. ONLY. SEE SHT. 2 C/N#4101 CLL 7-29-97 |
| 5 | SEE SHEET 2. C/N#4226 MER 10-16-97 |

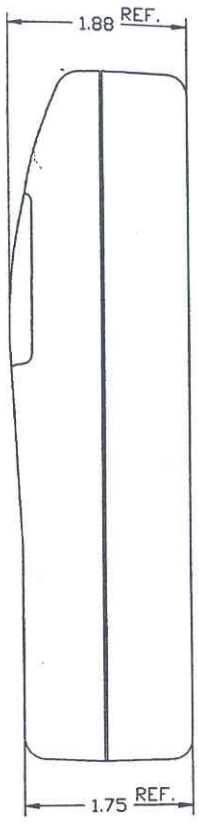
ORIGINAL

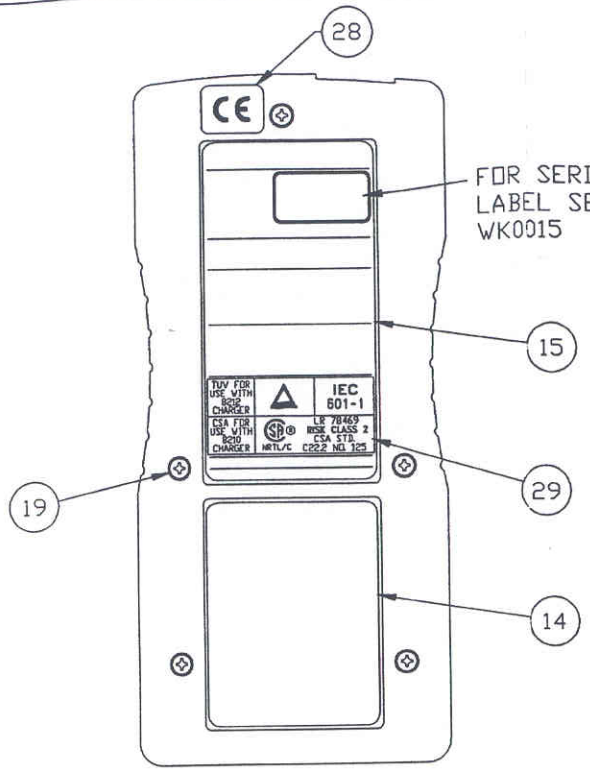
BCI INTERNATIONAL

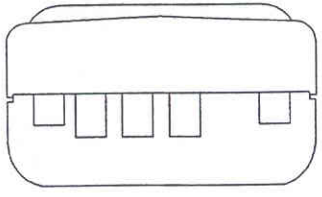
| | | |
|---|---|---|
| DRAWN BY: RJR | CHK. BY: E.Palatnik | ENG. APPR: M.S.Geisler |
| DATE: 9-12-95 | DATE: 9-19-95 | DATE: 9-19-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR: D.Siefert |
| THIS DOCUMENT CONTAINS CONFIDENTIAL AND/OR PROPRIETARY INFORMATION AND IS NOT TO BE RE-PRODUCED, DISTRIBUTED OR DISCLOSED WITHOUT PRIOR APPROVAL OF BCI INTERNATIONAL OR ITS DESIGNATED AGENT. | | DATE: 9-19-95 |
| | | MFG. APPR: J.M.Peter |
| | | DATE: 9-19-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ± .020 XXX: ± .005 ANGLES: ± 1° |
| FINISH: | | |
| TITLE: MDN F/ASM NEWDX3 (3303) | | DRWG NO: 72042A1 REV. 5 |
| | | SHT. 1 OF 2 |

A-8



| DRWG NO: 72042A1 | |
|---|---|
| REV. | DESCRIPTION |
| 1 | ADDED ITEM 28. C/N2500 SDP 4-4-96 |
| 2 | ADDED ITEM 29. C/N2530 SDP5/17/96 |
| 3 | ADDED ITEMS 30-32 C/N 3024 KMK 4-4-97 |
| 4 | PICTORIALLY CHANGED ITEM 1, SEE SHEET 1 C/N#4101 CLL 7-29-97 |
| 5 | ITEM 29 WAS ITEMS 29, 30, 31, & 32. C/N#4226 MER 10-16-97 |

ORIGINAL

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: RJR | CHK. BY: E.Palatnik | ENG. APPR.: M.S.Geisler |
| DATE: 9-12-95 | DATE: 9-19-95 | DATE: 9-19-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
| | | DATE: 9-19-95 |
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 9-19-95 |



MATERIAL:

FINISH:

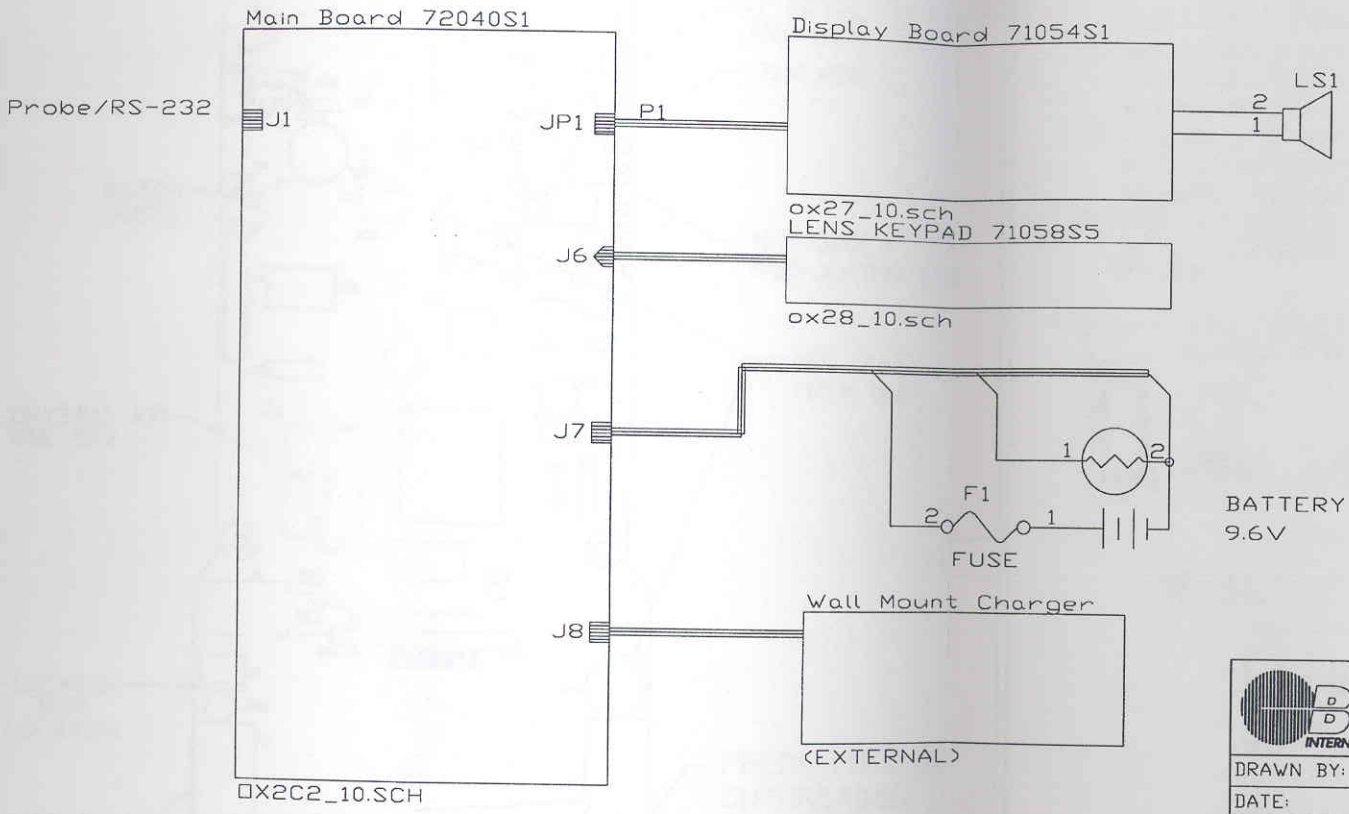
TOLERANCE UNLESS OTHERWISE SPECIFIED:
XX: ± .020
XXX: ± .005
ANGLES: ± 1°

TITLE: MON F/ASM NEWOX3 (3303)

DRWG NO: 72042A1 REV. 5

SHT. 2 OF 2

| DRWG NO: 72042S1 | |
|---|---|
| REV. | DESCRIPTION |
| | |




| BCI INTERNATIONAL | | |
|---|---|---|
| DRAWN BY: RJR | CHK. BY: E. Palatak | ENG. APPR.: J.M. Lutz |
| DATE: 1-6-96 | DATE: 1-8-96 | DATE: 1-8-96 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: |
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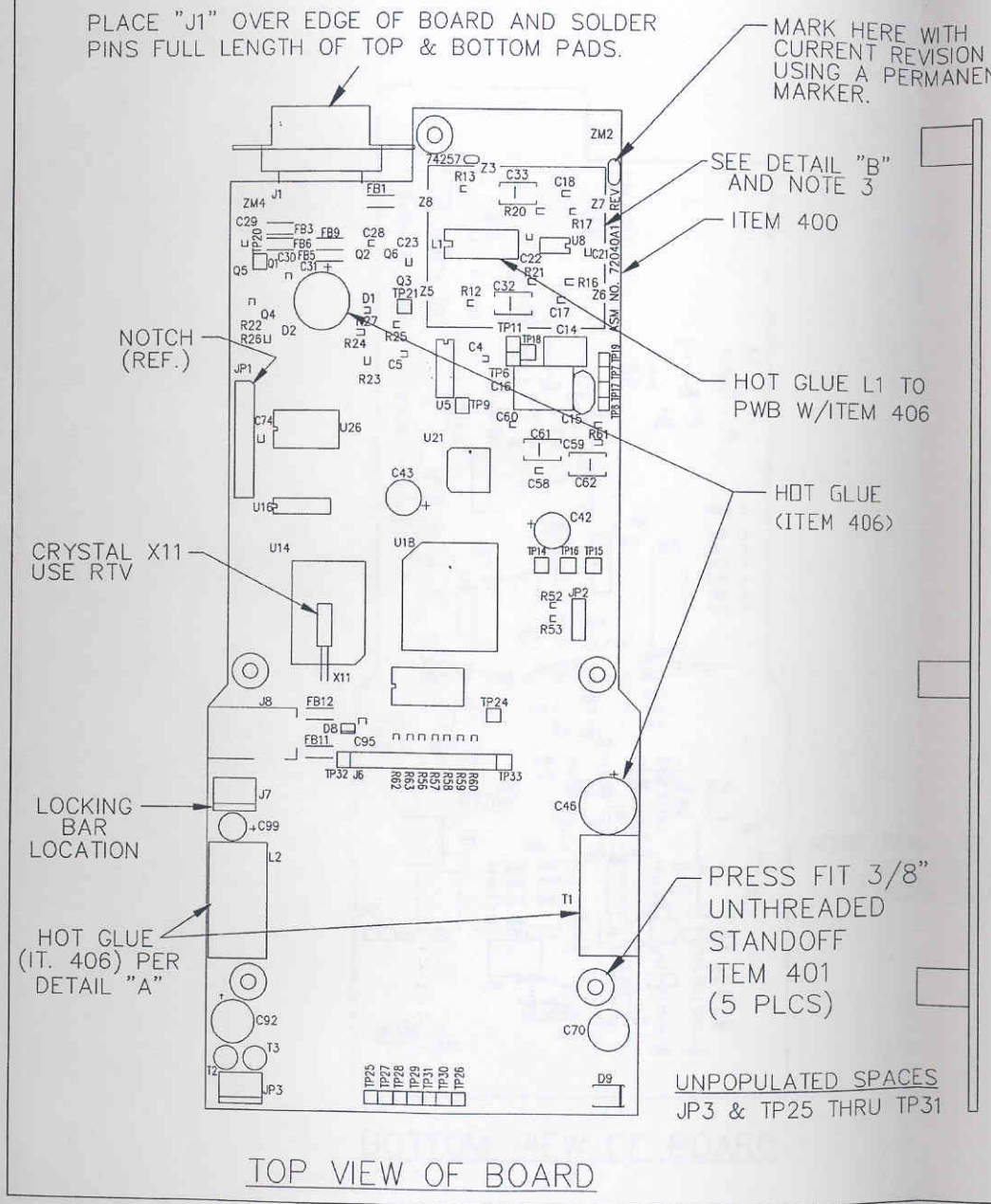
| | | MFG. APPR. |
| | | DATE: 1-9-96 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: SCHEMATIC SYSTEM NEW□X3 | | DRWG NO: 72042S1 REV. 0 |
| | | SHT. 1 OF 1 |

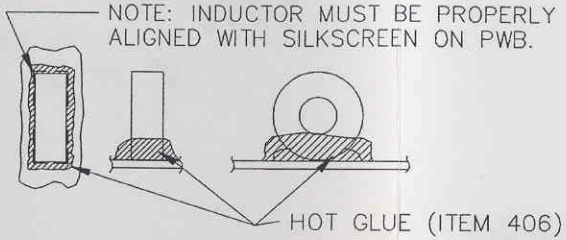
A-10




TOP VIEW OF BOARD

NOTES:

1) MANUFACTURER TO PLACE A "MFD. BY" IDENTIFICATION MARK ON BOARD.
2) IF MANUFACTURER TESTS BOARDS A TEST STAMP MUST BE PLACED ON THE BOARD INDICATING IT PASSED ALL TESTS.
3) COVER SHIELD ITEM 403 IS TO BE ASSEMBLED PER DETAIL "B" ON SHT2 AND MOUNTED BY VENDOR.
4) VENDOR IS TO BUY, PROGRAM AND INSTALL E-PROM PER SOFTWARE ASSEMBLY ITEM 403.
5) USE HOT MELT GLUE (ITEM 406) TO AFFIX C31,C46,L2 AND T1 TO MAIN BOARD.




DETAIL "A"

| DRWG NO: 72040B1 | |
|---|---|
| REV. | DESCRIPTION |
| 11 | ADDED ITEM 408, ADDED NOTE TO SHEET 2, SEE SHEET 5 C/N # 2830 CLL 1-2-97 |
| 12 | ADDED EPIC TO IT. 408. C/N# 2980 SDP 2-27-97 |
| 14 | UPDATED DWG. REV. #'s EAR# 2801 MER 5-16-97 |
| 15 | SEE SHEET 3. C/N 4391 MER 4-15-98 |
| 16 | ADDED HOT GLUE TO L1 C/N 4549 MAM 9-9-98 |

ORIGINAL

SHEETS 3-5 "V" SIZE (BOM)

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: RJR | CHK. BY: E.Palatnik | ENG. APPR.: M.S.Geisler |
| DATE: 9-18-95 | DATE: 9-19-95 | DATE: 9-19-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
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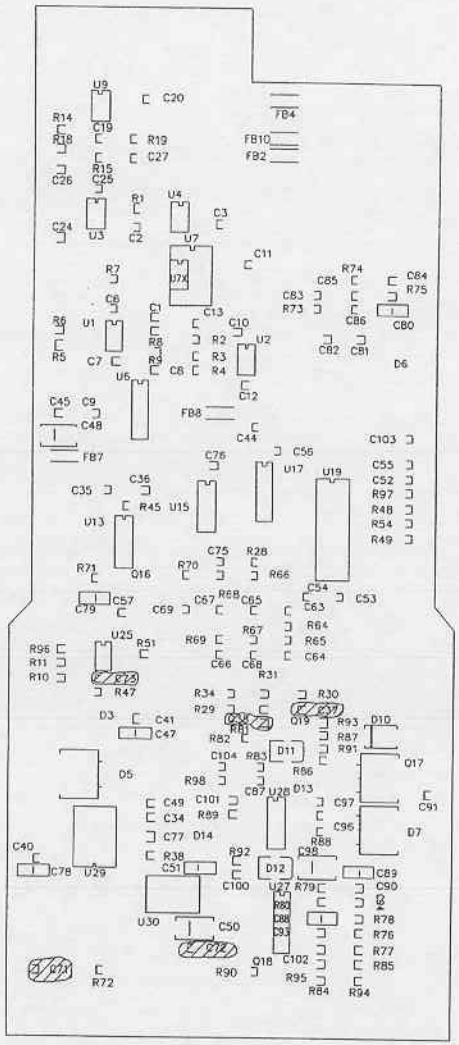
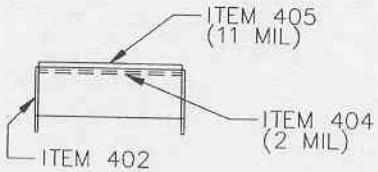
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 9-19-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ± .010 XXX: ± .005 ANGLES: ± 1° |
| FINISH: | | |
| TITLE: PWB ASM MAIN NEW□X3 | | DRWG NO: 72040B1 REV. 16 |
| | | SHT. 1 OF 5 |

A-11



BOTTOM VIEW OF BOARD




DETAIL "B"

NOTE: SEAL C37, C38,
C71, C72 & C73
USING ITEM 408

| DRWG. NO: 72040B1 | |
|---|---|
| REV. | DESCRIPTION |
| 1 | SEE SHEET 1 RJR 9-18-95 |
| 2 | SEE SHEET 1. KMF 11-27-95 |
| 3 | SEE SHEET 1. JPR 1-17-96 |
| 4 | SEE SHEET 1. KMF 2-2-96 |
| 5 | SEE SHEET 1. KMK 3-7-96 |
| 6 | SEE SHEET 1. SDP 3-21-96 |
| 7 | SEE SHEET 1. SDP 5/2/96 |
| 8 | SEE SHEET 1. SDP 5/3/96 |
| 9 | CLARIFIED POLARITY OF D10 ALSO SEE SHEET 1. EAR# 2126 SDP 7/12/96 |
| 10 | SEE SHEET 1 C/N 2767 NLL 10/21/96 |
| 11 | ADDED NOTE, SEE SHEETS 1 & 5 C/N 2830 CLL 1-2-97 |
| 12 | SEE SHEET 1. C/N# 2980 SDP 2-27-97 |
| 14 | SEE SHEET 1. EAR# 2801 MER 5-16-97 |
| 15 | SEE SHEET 3. C/N 4391 MER 4-15-98 |
| 16 | SEE SHEET 1. C/N 4549 MAM 9-9-98 |

ORIGINAL

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: RJR | CHK. BY: E.Palatnik | ENG. APPR: M.S.Geister |
| DATE: 9-18-95 | DATE: 9-19-95 | DATE: 9-19-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR: D.Siefert |
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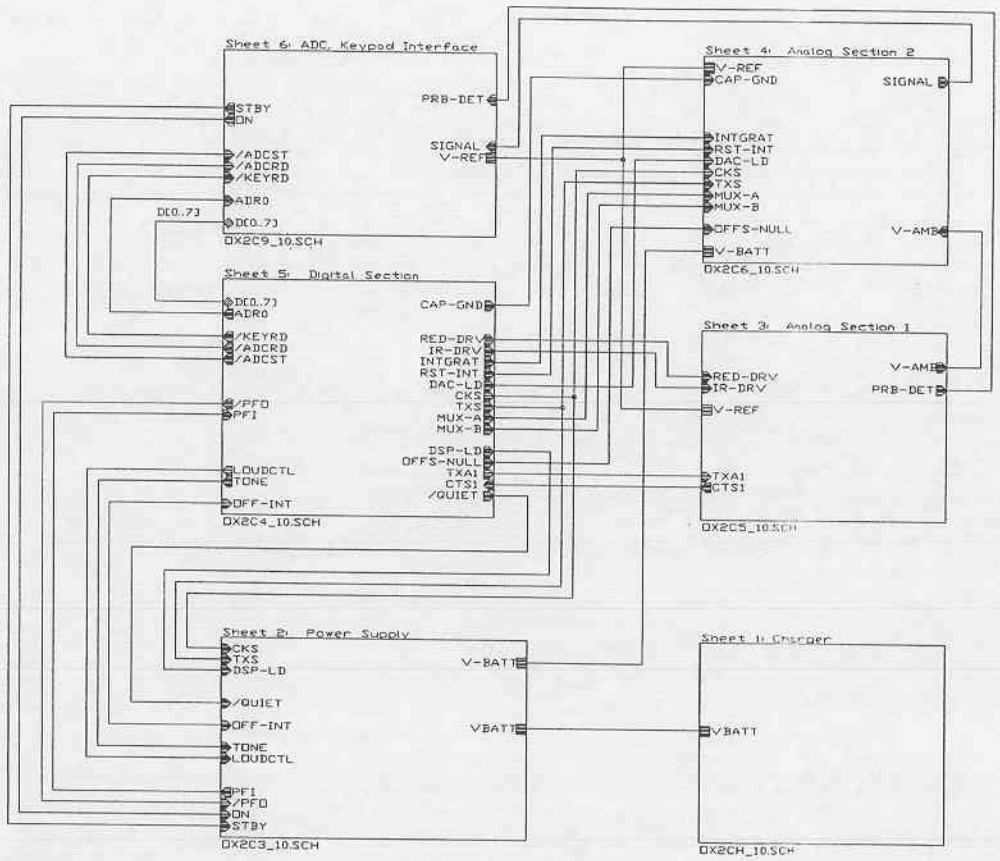
| MATERIAL: | | MFG. APPR: J.M.Peter |
| FINISH: | | DATE: 9-19-95 |
| TITLE: PWB ASM MAIN NEWDX3 | | TOLERANCE UNLESS OTHERWISE SPECIFIED XX ± .010 XXX ± .005 ANGLES ± 1° DRWG NO: 72040B1 REV: 16 SHT 2 OF 5 |

| DRWG NO: 72040S1 | |
|---|---|
| REV. | DESCRIPTION |
| 1 | SEE SHEET 4. 2-2-96 |
| | |




ORIGINAL

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: KMF | CHK. BY: E.Palatnik | ENG. APPR.: M.S.Geisler |
| DATE: 10-16-95 | DATE: 10-16-95 | DATE: 10-16-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
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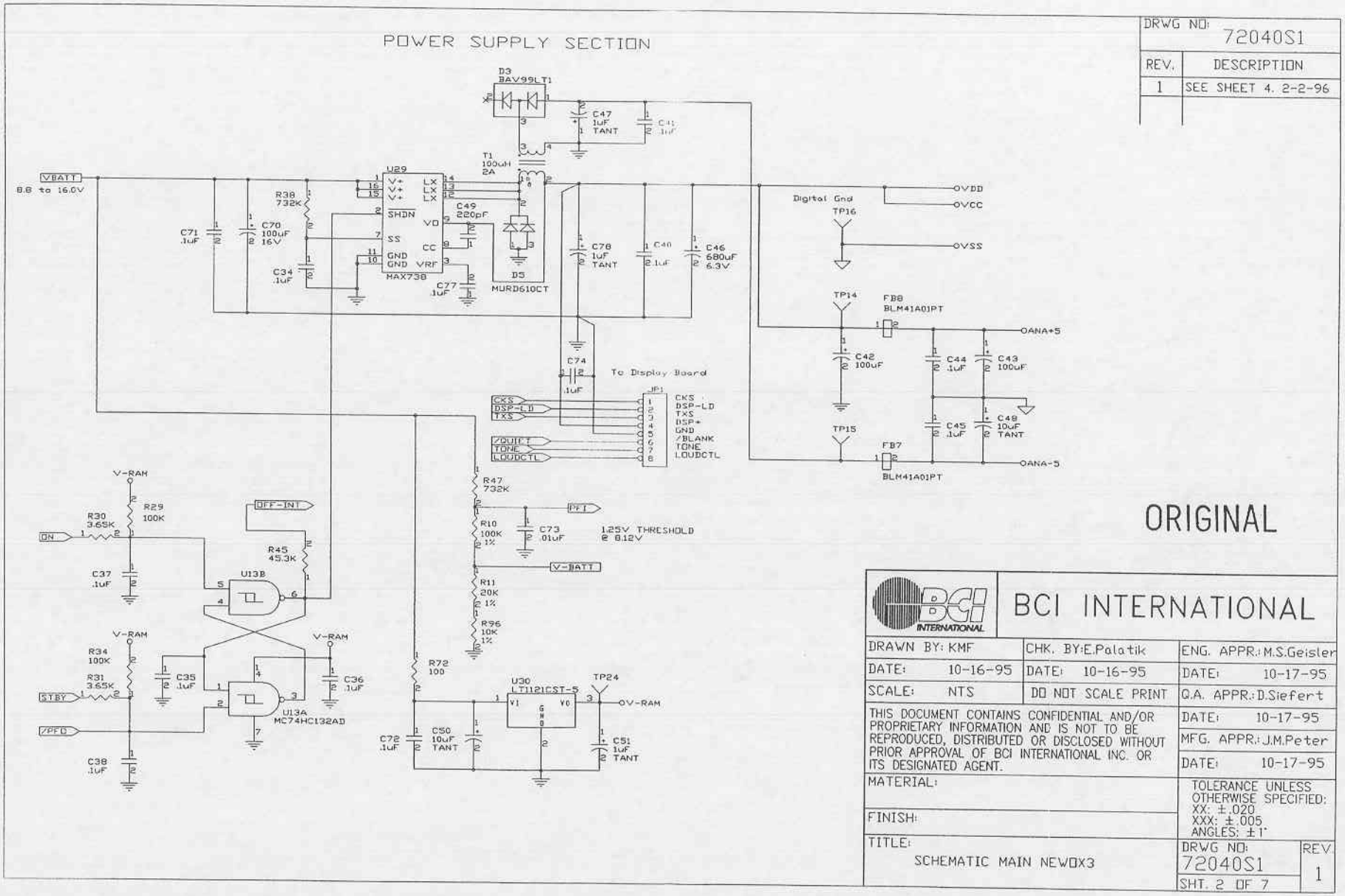
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 10-17-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: SCHEMATIC MAIN NEWOX3 | DRWG NO: 72040S1 | REV. 1 |
| | SHT. 1 OF 7 | |

A-13

# POWER SUPPLY SECTION




| DRWG NO: | 72040S1 |
|---|---|
| REV. | DESCRIPTION |
| 1 | SEE SHEET 4. 2-2-96 |

ORIGINAL

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: KMF | CHK. BY: E.Palatik | ENG. APPR.: M.S.Geisler |
| DATE: 10-16-95 | DATE: 10-16-95 | DATE: 10-17-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
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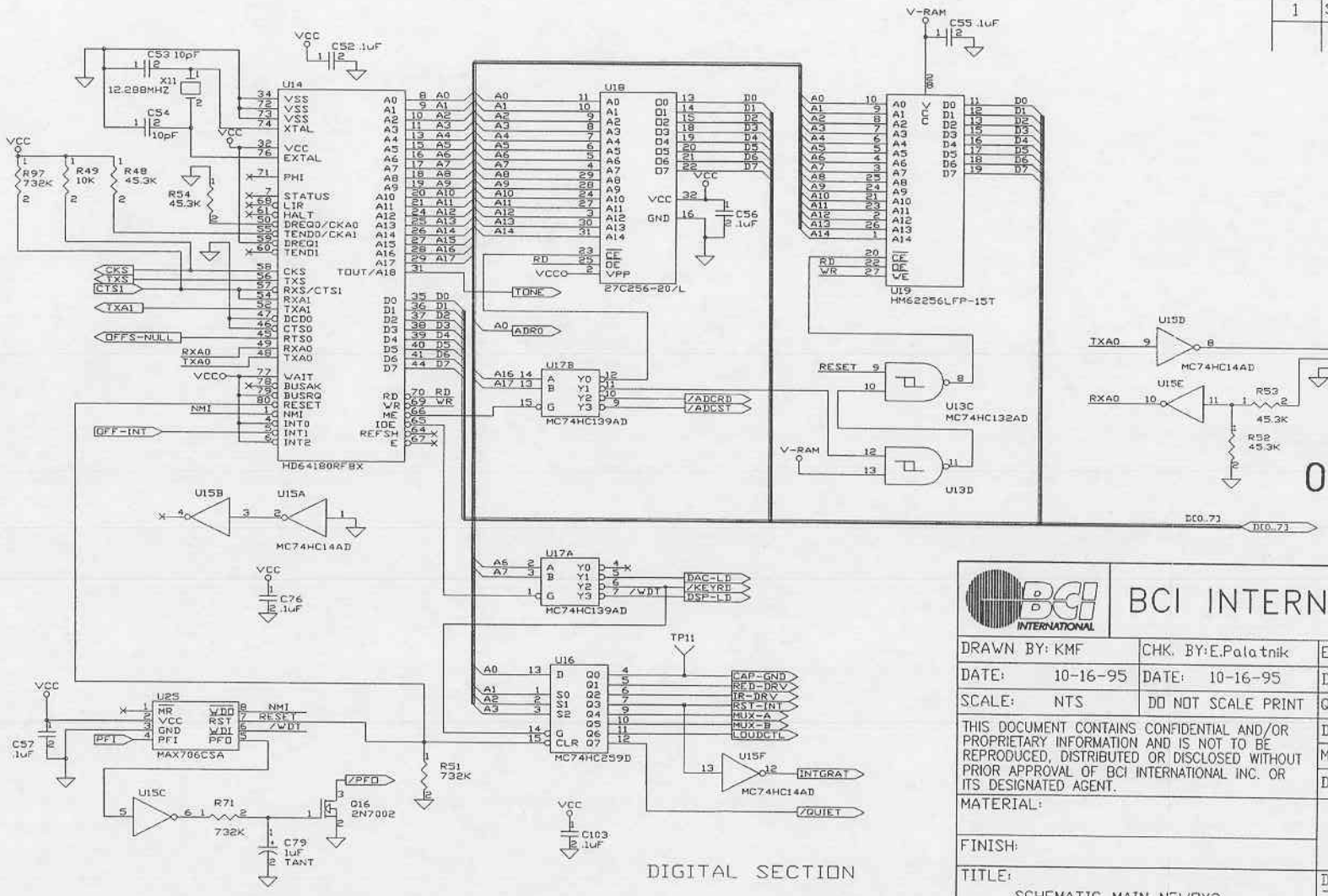
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 10-17-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: SCHEMATIC MAIN NEWDX3 | DRWG NO: 72040S1 | REV 1 |
| | SHT. 2 OF 7 | |

A-14

| DRWG NO: 72040S1 | |
|---|---|
| REV. | DESCRIPTION |
| 1 | SEE SHEET 4, 2-2-96 |
| | |




| | | |
|---|---|---|
| BCI INTERNATIONAL | | |
| DRAWN BY: KMF | CHK. BY: E.Palatnik | ENG. APPR.: M.S.Geisler |
| DATE: 10-16-95 | DATE: 10-16-95 | DATE: 10-17-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
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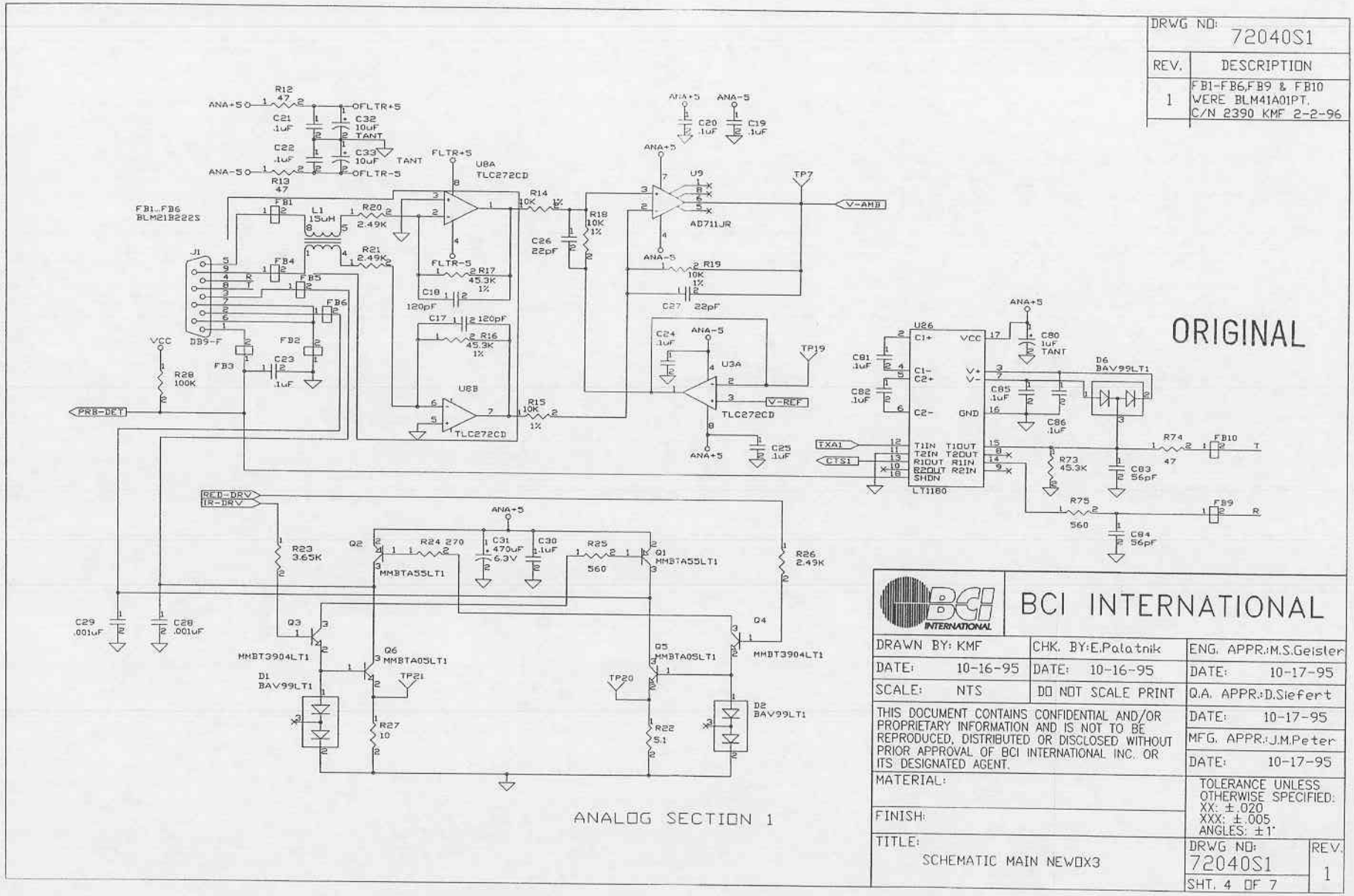
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 10-17-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: SCHEMATIC MAIN NEWOX3 | DRWG NO: 72040S1 | REV. 1 |
| | SHT. 3 OF 7 | |

A-15


DRWG NO: 72040S1
REV. DESCRIPTION
1 FB1-FB6,FB9 & FB10 WERE BLM41A01PT. C/N 2390 KMF 2-2-96
ORIGINAL
ANALOG SECTION 1
BCI INTERNATIONAL
DRAWN BY: KMF
CHK. BY: E.Palatnik
ENG. APPR.: M.S.Geisler
DATE: 10-16-95
DATE: 10-16-95
DATE: 10-17-95
SCALE: NTS
DO NOT SCALE PRINT
Q.A. APPR.: D.Siefert
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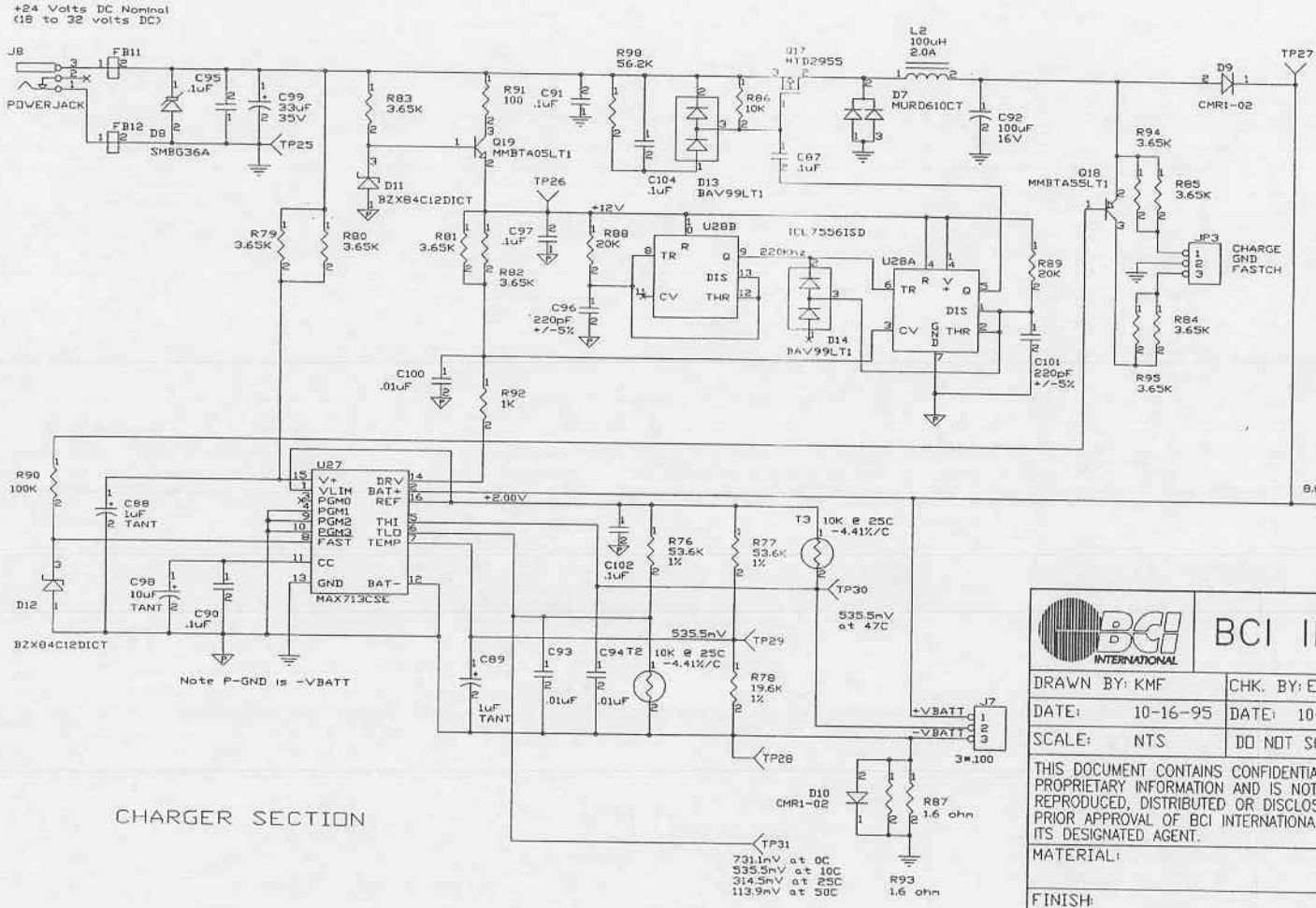
DATE: 10-17-95
MFG. APPR.: J.M.Peter
DATE: 10-17-95
MATERIAL:
FINISH:
TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1°
TITLE: SCHEMATIC MAIN NEWDX3
DRWG NO: 72040S1
REV. 1
SHT. 4 OF 7
A-14

| DRWG NO: | 72040S1 |
|---|---|
| REV. | DESCRIPTION |
| 1 | SEE SHEET 4. 2-2-96 |
| | |




BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: KMF | CHK. BY: E.Palatnik | ENG. APPR.: M.S.Geisler |
| DATE: 10-16-95 | DATE: 10-16-95 | DATE: 10-17-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
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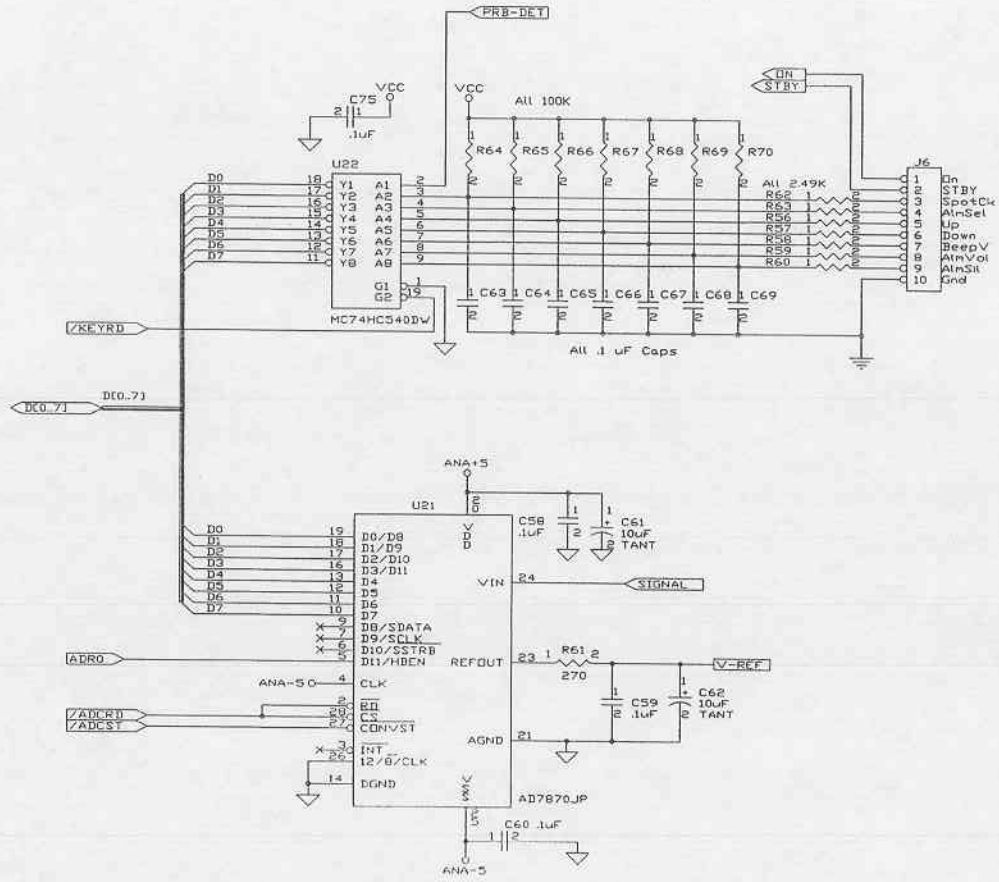
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 10-17-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: SCHEMATIC MAIN NEWOX3 | DRWG NO: 72040S1 | REV. 1 |
| | SHT. 5 OF 7 | |

A-17

| DRWG NO: | 72040S1 |
|---|---|
| REV. | DESCRIPTION |
| 1 | SEE SHEET 4. 2-2-96 |
| | |




ADC, Keypad Interface

ORIGINAL

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: KMF | CHK. BY: E.Palatnik | ENG. APPR.: M.S.Geisler |
| DATE: 10-16-95 | DATE: 10-16-95 | DATE: 10-17-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
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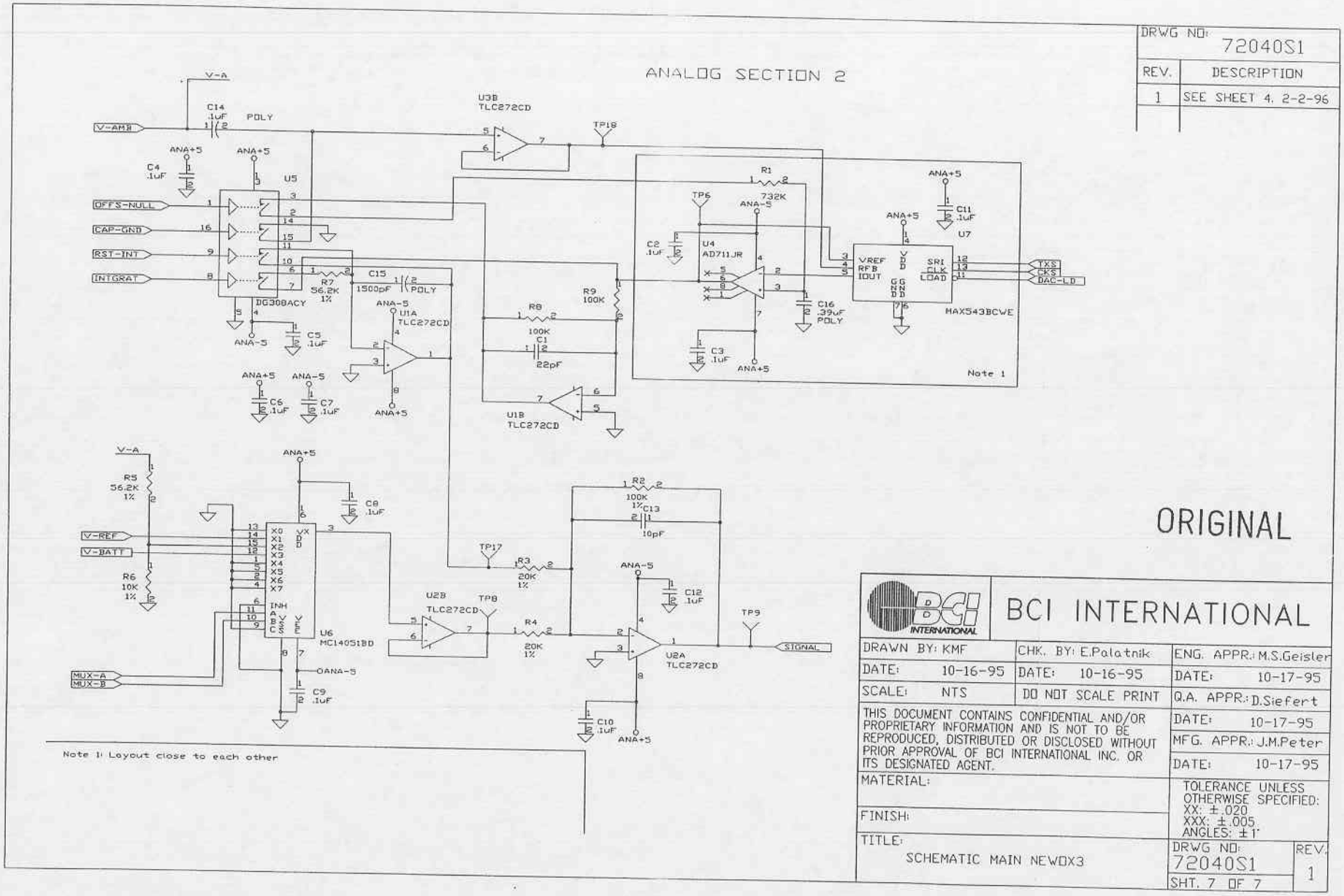
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 10-17-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED XX: ± .020 XXX: ± .005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: SCHEMATIC MAIN NEWDX3 | | DRWG NO. 72040S1 REV 1 SHT. 4 OF 7 |




| DRWG NO: 72040S1 | |
|---|---|
| REV. | DESCRIPTION |
| 1 | SEE SHEET 4. 2-2-96 |
| | |

ORIGINAL

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: KMF | CHK. BY: E.Palatnik | ENG. APPR.: M.S.Geisler |
| DATE: 10-16-95 | DATE: 10-16-95 | DATE: 10-17-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
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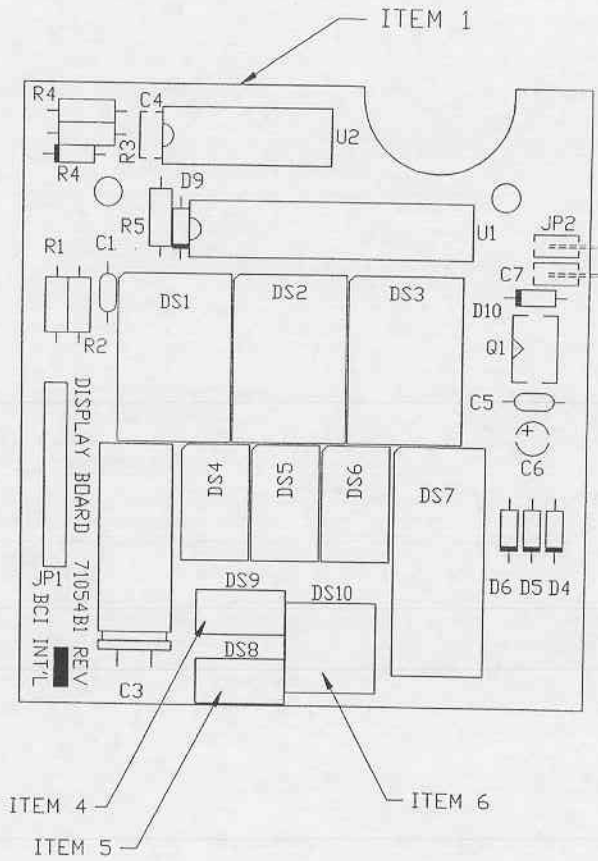
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 10-17-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: SCHEMATIC MAIN NEWDX3 | | DRWG NO: 72040S1 REV. 1 |
| | | SHT. 7 OF 7 |

A-19




ITEM 2

ITEM 3
CUT (2) PIECES 2" LONG
AND SOLDER FROM J2 (BOTTOM
SIDE OF BOARD) TO SPEAKER (ITEM 2).

| DRWG NO: 71054A1 | |
|---|---|
| REV. | DESCRIPTION |
| 1 | ADDED ITEM'S 4-6. EAR# 2257 SDP 9-4-96 |

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: K.Formella | CHK. BY: C.M.H. | ENG. APPR.: C.M.H. |
| DATE: 7-7-95 | DATE: 7-13-95 | DATE: 7-13-95 |
| SCALE: NTS | DO NOT SCALE PRINT | Q.A. APPR.: D.Siefert |
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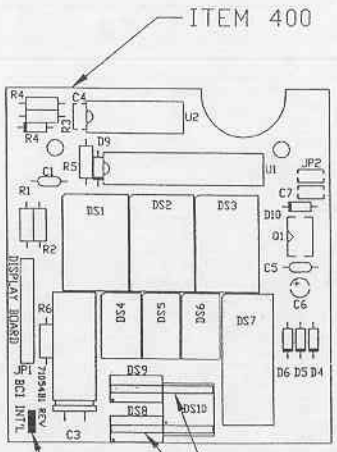
| | | MFG. APPR.: J.M.Peter |
| | | DATE: 7-13-95 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: PWB ASM DISPLAY WITH SPEAKER NEWDX2 | DRWG NO: 71054A1 | REV. 1 |
| | SHT. 1 OF 1 | |

A-20

ORIGINAL

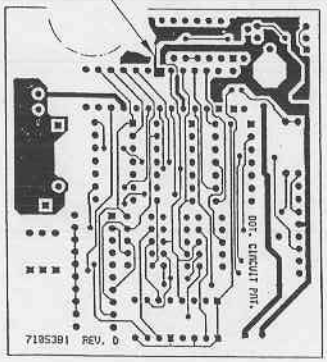



NOTE:

1. MANUFACTURER TO PLACE A "MFD. BY" IDENTIFICATION MARK ON BOARD.
2. LEADS MUST BE TRIMMED TO WITHIN .03 OF THE BACK OF THE FINISHED BOARD.
3. IF MANUFACTURER TESTS BOARDS, A TEST STAMP MUST BE PLACED ON BOARD INDICATING IT PASSED ALL TESTS.
4. HOT MELT GLUE, ITEM 401, TO BE USED TO SECURE C3 TO DISPLAY BOARD.
5. IMPORTANT: ALL COMPONENTS MUST BE MOUNTED AS CLOSE TO THE BOARD AS POSSIBLE. (C4 & C7 MUST BE MOUNTED FLUSH OR LOWER THAN U2.)
6. IF DISPLAY LEDs EXHIBIT ANY "FLICKERING" WHEN INSTALLED IN A FINISHED PULSE OXIMETER UNIT AT BCI. THE TRACE INDICATED IN BOTTOM CIRCUIT VIEW CAN BE CUT TO ELIMINATE THE FLICKER.
7. HOLES OF JP2 TO BE MASKED (NOT FILLED WITH SOLDER).

| DRWG NO: 71054B1 | |
|---|---|
| REV. | DESCRIPTION |
| B | REDESIGNEDED TO REDUCE MONITOR SIZE. RJR 1-29-93 |
| Ø | CHANGED R4 & R5 FROM 10 OHMS TO 36 OHMS. C/N1679. RJR 7-06-93 |
| 1 | ADDED JUMPER WIRE PER C/N1690. RJR 7-28-93 |
| 2 | REMOVED DS8, 9 & 10 FROM BOM. C/N1709 RJR 9-3-93 |
| 3 | ADDED TRIM LEADS NOTE 2. C/N1789 RJR 2-10-94 |
| 4 | REVISED TO REFLECT NEW LAYOUT. C/N1789 RJR 2-10-94 |
| 5 | ADDED NOTE 3. C/N1878 RJR 7-20-94 |
| 6 | ADDED NOTE 4. C/N1919 BE 9/22/94 |
| 7 | R4 WAS 13K; R5 WAS 5.62K. (EAR #784) DRH 2-3-95 |
| 8 | REMV'D DS8-DS10. EAR # 2257 SDP 9-3-96 |
| 9 | ADDED NOTE 5. C/N 2981 MER 3-21-97 |
| 10 | CHANGED NOTE 2. (.03 WAS .02) C/N 3085 MER 5-14-97 |
| 11 | CHANGED NOTE 5. (C4 & C7 HEIGHT SPECIFIED.) C/N 4138 MER 8-18-97 |
| 12 | CHANGED R4 TO 30.1K & R5 TO 5.62K SHT.2 C/N4359 MAM 3/2/98 |
| 13 | UPDATED ARTWORK. ADDED NOTES 6 & 7 AND BOTTOM CIRCUIT VIEW. C/N4424 MER 10/22/98 |
| 14 | CHANGE NOTE REGARDING NOTES 7 AND TRACE TO ELIMINATE FLICKER. C/N4767 TAW 3/10/99 |

CUT THIS TRACE TO ELIMINATE FLICKER, PRESENT IN A FINISHED PULSE OXIMETER UNIT.




BOTTOM CIRCUIT VIEW

SHEET 2 IS "V" SIZE (BOM)

ORIGINAL

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: RJR | CHK. BY: D.Hegerty | ENG. APPR.: E.Palatnik |
| DATE: 10-15-92 | DATE: 7-9-93 | DATE: 7-9-93 |
| SCALE: ~ | DO NOT SCALE PRINT | Q.A. APPR.: P.Boese |
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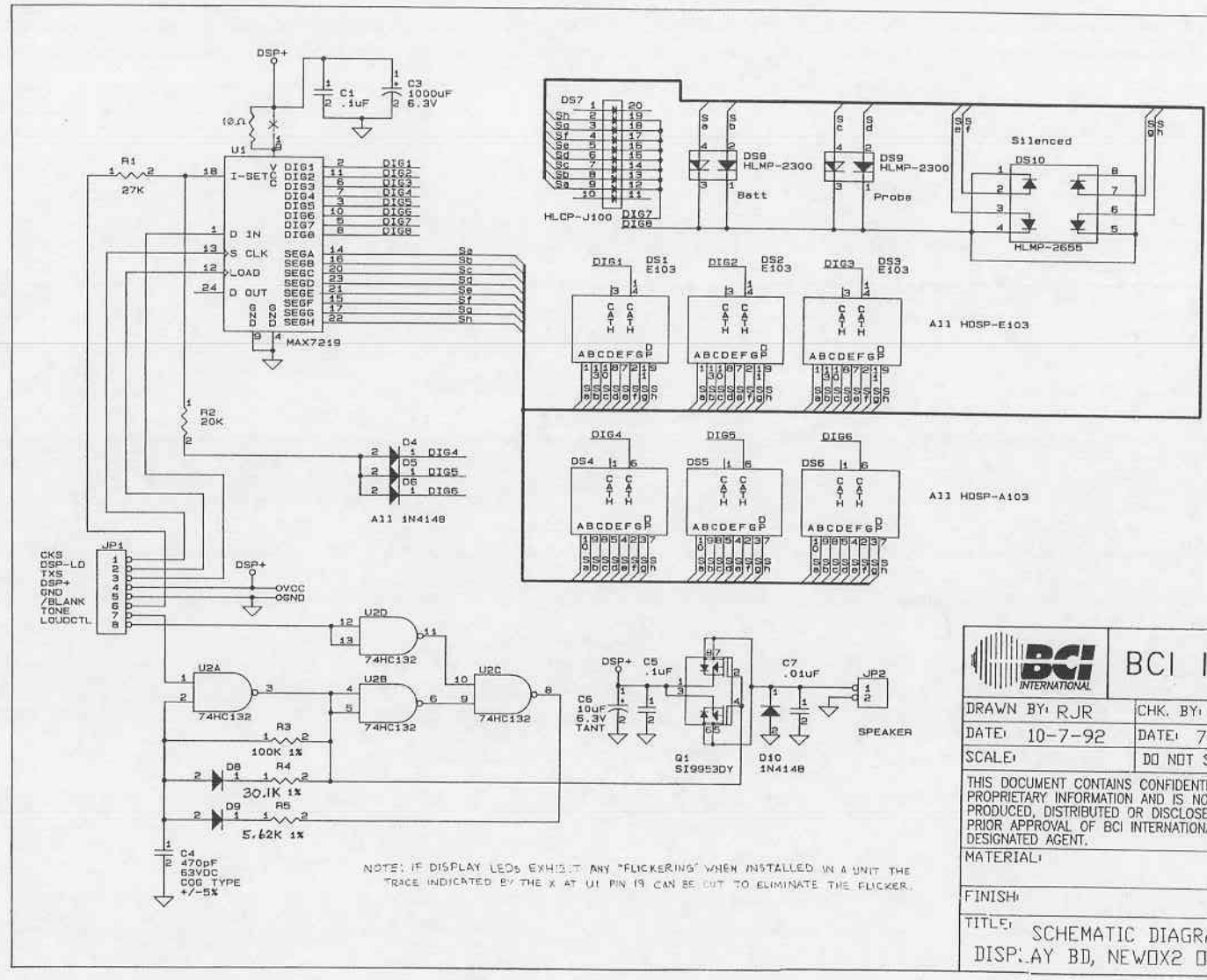
| | | MFG. APPR.: M.Sanderson |
| | | DATE: 7-7-93 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ± .020 XXX: ± .005 ANGLES: ± 1° |
| FINISH: | | |
| TITLE: PWB ASM DISPLAY NEWDX2 | | DRWG NO: 71054B1 REV. 14 |
| | | SHT. 1 OF 2 |




| DRWG NO: 71054S1 | |
|---|---|
| REV. | DESCRIPTION |
| B | PINOUT WAS CHANGED ON DS1, 2 & 3. RJR 11-23-92 |
| Ø | CHANGED R4 & R5 FROM 10 OHMS TO 36 OHMS. C/N#1679. RJR 7-06-93 |
| 1 | ADDED C5, C6, C7, D9, D10 & Q1, C4 WAS .1uF, R3 WAS 27K, R4 WAS 36, R5 WAS 36, U2 WAS MC74HCD4AN. C/N#1802 RJR 3-4-94 |
| 2 | R4 WAS 13K; R5 WAS 6.49K (EAR #784) DRH 2-3-95 |
| 3 | ADDED 10Ω RESISTOR. C/N 4424 MER 9-11-98 |

BCI INTERNATIONAL

| | | |
|---|---|---|
| DRAWN BY: RJR | CHK. BY: D.Hegerty | ENG. APPR.: E.Palatnik |
| DATE: 10-7-92 | DATE: 7-9-93 | DATE: 7-9-93 |
| SCALE: | DO NOT SCALE PRINT | Q.A. APPR.: P.Boese |
| THIS DOCUMENT CONTAINS CONFIDENTIAL AND/OR PROPRIETARY INFORMATION AND IS NOT TO BE RE-PRODUCED, DISTRIBUTED OR DISCLOSED WITHOUT PRIOR APPROVAL OF BCI INTERNATIONAL OR ITS DESIGNATED AGENT. | | DATE: 7-12-93 |
| | | MFG. APPR.: M.Sanderson |
| | | DATE: 7-9-93 |
| MATERIAL: | | TOLERANCE UNLESS OTHERWISE SPECIFIED: XX: ±.020 XXX: ±.005 ANGLES: ±1° |
| FINISH: | | |
| TITLE: SCHEMATIC DIAGRAM DISPLAY BD, NEWOX2 OXIMETER | DRWG NO: 71054S1 | REV. 3 |
| | SHT. 1 OF 1 | |

A-72

# BCI INTERNATIONAL

DRAWING NO. 20613B1

TITLE: CHARGER/POWER SUPPLY ISOLATED 24VDC OUTPUT/105-125VAC INPUT

DWG. CODE: B

SHEET 1 OF 2

REV. NO. 1

Revisions

## I. SPECIFICATIONS:

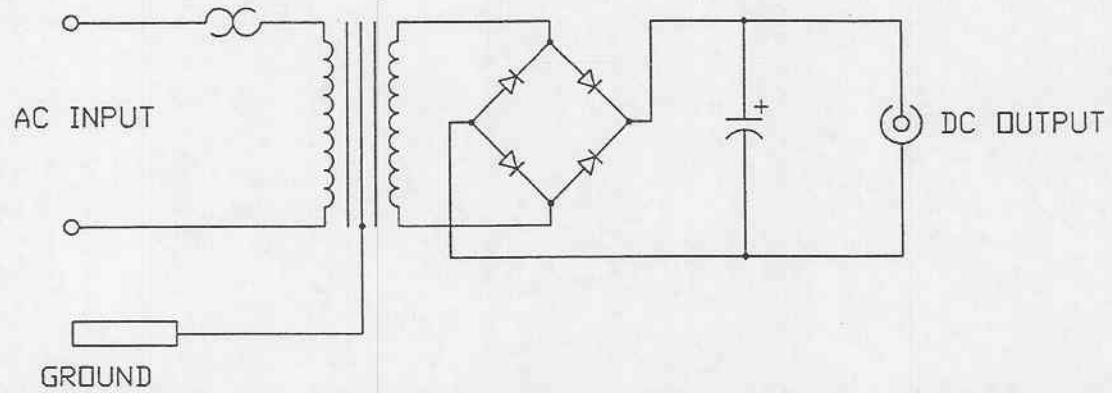
| | |
|---|---|
| A. Input Voltage | 105 - 125 VAC w/U.S. Standard Ground Pin |
| B. Frequency | 60 Hz |
| C. Output Voltage | 24VDC @ 120VAC Input |
| D. Output Current | 500mA |
| E. Isolation Requirements | |
| Primary to ground pin | 1500V RMS |
| Primary to Secondary | 2500V RMS |
| Secondary to ground pin | 2500V RMS |
| F. Output Cord | 20AWG, 6 ft. Lg. with 5.5mm X 2.5mm Plug |
| G. Construction | Per UL-544 and CSA C22.2 NO. 125 |
| H. Charger Markings | See Sheet 2 |
| I. Max. Temperature Rise | 50° C |
| J. Thermal Cutout | 130° C, UL Rec. Component in series with primary. Elcut #U-23 or equiv. |
| K. Windings | |
| Primary | 850 turns of 29 AWG |
| Secondary | 180 turns of 24 AWG |
| L. Rectifier | Full Wave Bridge |
| M. Filter Capacitor | 1000 uF 35V |

N. Fair-Rite core #2643023002 to be shrink-wrapped in place on end of output cordset per dwg.

## II. HIPOT TESTING

To be performed on each unit by the manufacturer.

A. 4800 VAC primary to secondary, 1 sec.
B. 1500 VAC primary to top core, 1 sec.
C. 800 VAC secondary to top core, 1 sec.



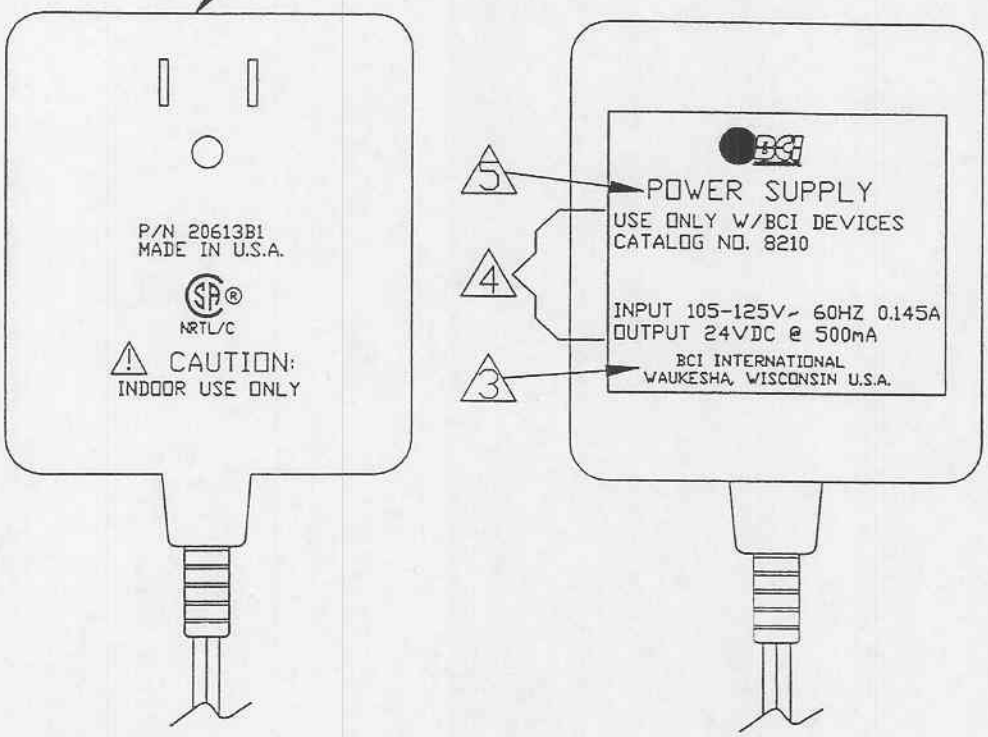

1 MER 6-11-97 SEE SHEET 2. C/N 4024

ORIGINAL

| DRAWN BY DAU | APPROVALS M.S. GEISLER | | DWG. NO. 20613B1 |
|---|---|---|---|
| ISSUED 1-4-94 | J.M. PETER 5-26-95 | D. SEIFERT | SHEET 1 OF 2 |

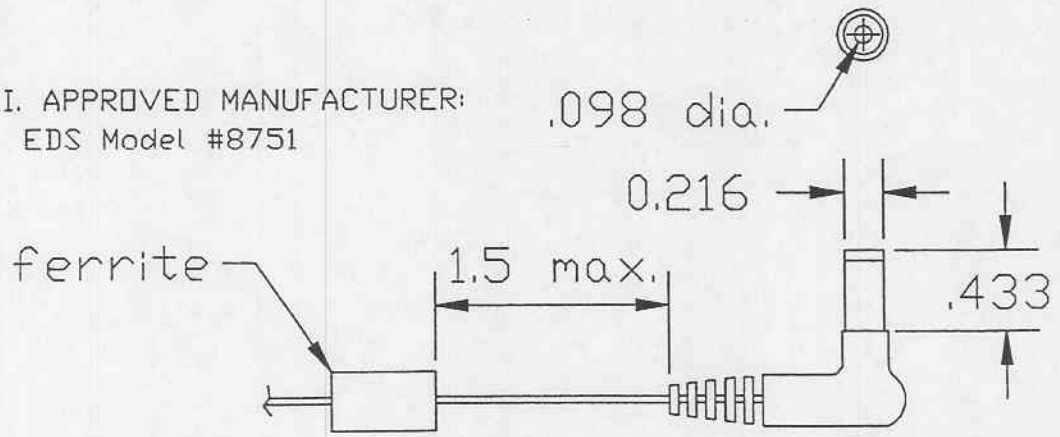
| BCI INTERNATIONAL | | DRAWING NO. 20613B1 |
|---|---|---|
| TITLE: CHARGER/POWER SUPPLY ISOLATED 24VDC OUTPUT/105-125VAC INPUT | DWG. CODE: B | SHEET 2 OF 2 |
| | | REV. NO. 1 |

ENCLOSURE SERIES JUMBO




NOTES:
1. CHARGER TO BE HOT STAMPED ON BOTH SIDES WITH INFORMATION SHOWN. INK MUST BE ALCOHOL RESISTANT.
2. CORD TO BE TERMINATED W/EDS #00968 PLUG SHOWN BELOW.
3. LETTERING TO BE 6PT HELVETICA MEDIUM.
4. LETTERING TO BE 10PT HELVETICA MEDIUM.
5. LETTERING TO BE 14PT HELVETICA MEDIUM.

III. APPROVED MANUFACTURER:
EDS Model #8751




Revisions

| | | |
|---|---|---|
| 1 | MER 6-11-97 | REMOVEED LOT NO. BOX & NOTE 2. RENUMBERED NOTES. SEE HISTORY FOR PREVIOUS REV. INFO. C/N 4024 |

| DRAWN BY DAU | APPROVALS | | DWG. NO. 20613B1 |
|---|---|---|---|
| ISSUED 1-4-94 | | | SHEET 2 OF 2 |

| BCI INTERNATIONAL | DRAWING NO. 20613B2 |
|---|---|
| TITLE: CHARGER/POWER SUPPLY ISOLATED 24VDC OUTPUT/208-252V~ INPUT | DWG. CODE B; SHEET 1 OF 3; REV. NO. 2 |

I. SPECIFICATIONS:

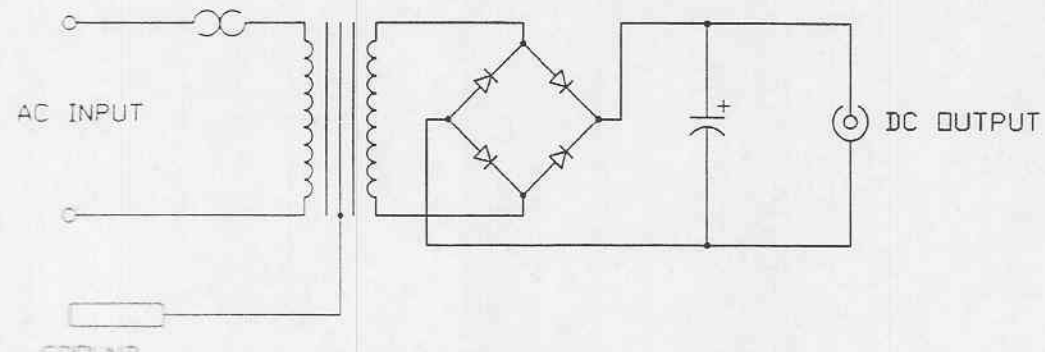
| | |
|---|---|
| A. Input Voltage | 208-252V~ w/European Style Plug with Ground Pin |
| B. Frequency | 50/60 Hz |
| C. Output Voltage | 24VDC @ 230VAC Input |
| D. Output Current | 500mA |
| E. Isolation Requirements | |
| Primary to secondary | 4000V RMS |
| Primary to ground pin and shield | 1500V RMS |
| Secondary to ground pin and shield | 500V RMS |
| Shield construnction to meet IEC-601 (57.9.4 a&d) requirements | |
| F. Output Cord | 20AWG, 6 ft. Lg. with 5.5mm X 2.5mm Plug |
| G. Input Cord | 18AWG, 6 ft. Lg. w/European Style Plug with Ground Pin |
| H. Construction | Per IEC-601 |
| I. Charger Markings | See Drawing (Sheet 2) |
| J. Max. Temperature Rise | 50° C |
| K. Thermal Cutout | 130° C, UL Rec. Component in series with primary. Elcut #U-23 or Elmwood Sensors #WA128 |
| L. Windings | |
| Primary | 1860 turns of 34 AWG |
| Secondary | 188 turns of 25 AWG |
| M. Rectifier | Full Wave Bridge |
| N. Filter Capacitor | 1000 uF 35V |

O. Fair-Rite core #2643023002 to be shrink-wrapped in place on end of output cordset per dwg.

II. HIPOT TESTING

To be performed on each unit by the manufacturer

A. 4800 VAC primary to secondary, 1 sec.

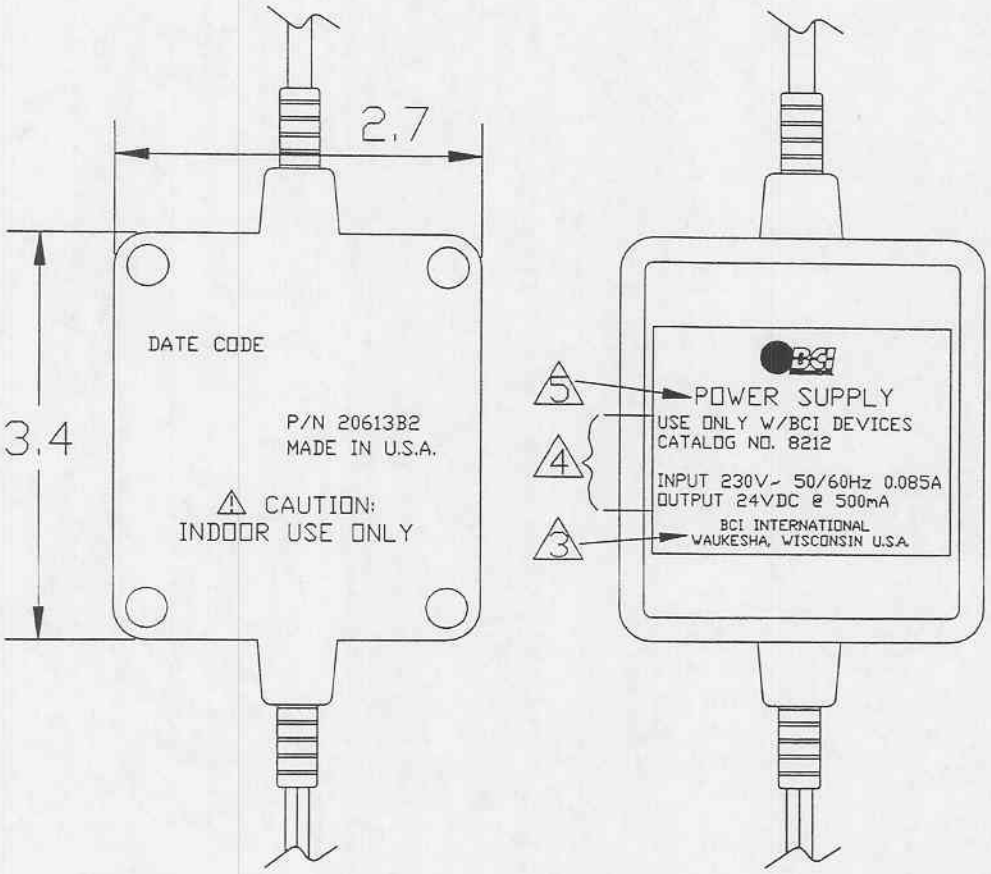



| Revisions | | |
|---|---|---|
| 1 | SDP 3-1-96 | WINDINGS WERE 1780 & 192 C/N 2410 |
| 2 | MER 6-4-97 | SEE SHEET 2. C/N 4024 |

ORIGINAL

| | | | |
|---|---|---|---|
| DRAWN BY: DAU | APPROVALS: M.S.GEISLER 5-26-95 | | DWG. NO. 20613B2 |
| DATED: 1-4-94 | J.M.PETER 5-26-95 | D.SIEFERT 5-26-95 | SHEET 1 OF 3 |

| BCI INTERNATIONAL | DRAWING NO. 20613B2 |
|---|---|
| TITLE: CHARGER/POWER SUPPLY ISOLATED 24VDC OUTPUT/208-252V~ INPUT | DWG. CODE: B |
| | SHEET 2 OF 3 |
| | REV. NO. 2 |



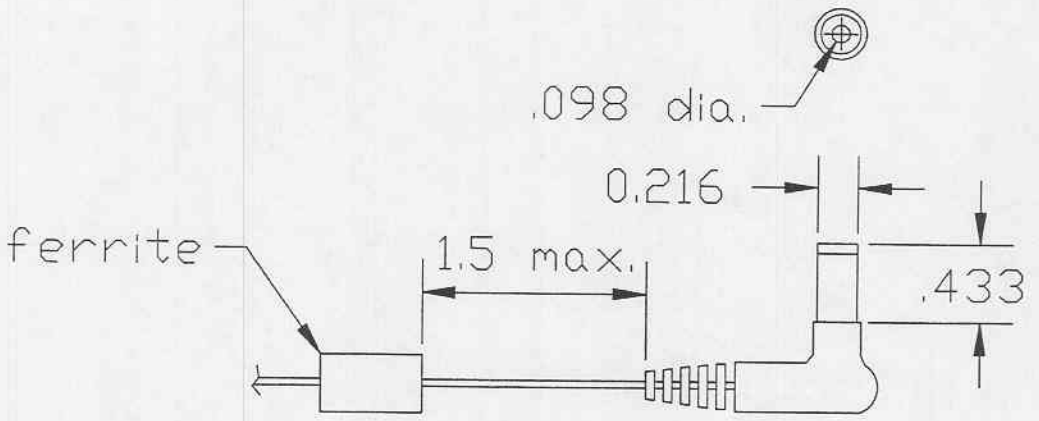

NOTES:
1. CHARGER TO BE HOT STAMPED ON BOTH SIDES WITH INFORMATION SHOWN. INK MUST BE ALCOHOL RESISTANT.
2. CORD TO BE TERMINATED WITH PLUGS PER SHEET 3.
3. LETTERING TO BE 6PT HELVETICA MEDIUM.
4. LETTERING TO BE 10PT HELVETICA MEDIUM.
5. LETTERING TO BE 14PT HELVETICA MEDIUM.

| Revisions | | | |
|---|---|---|---|
| 1 | SDP 3-1-96 | SEE SHEET 1 C/N 2410 | |
| 2 | MER 6-4-97 | REMOVED LOT NO. BOX & NOTE 2. RENUMBERED NOTES. C/N 4024 | |

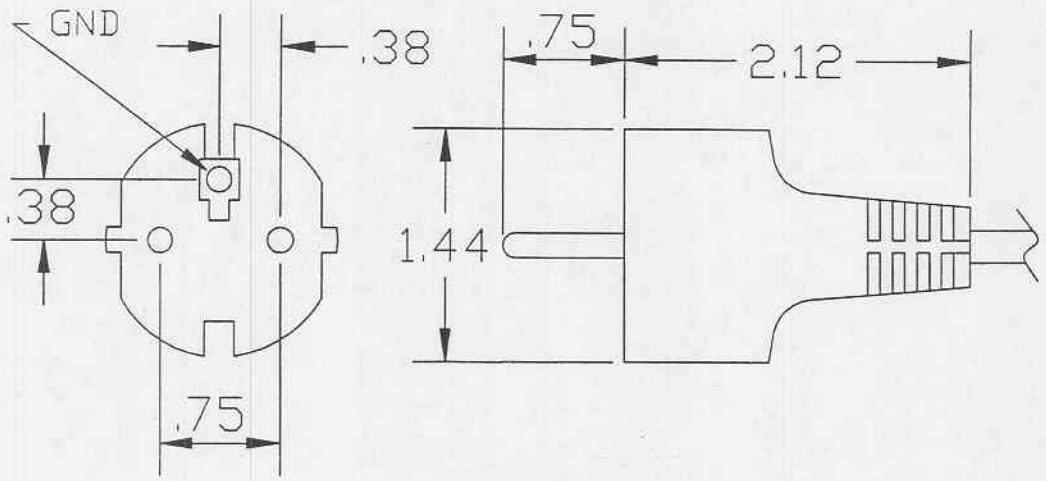
| DRAWN BY DAU | APPROVALS | | DWG. NO. 20613B2 |
|---|---|---|---|
| ISSUED 1-4-94 | | | SHEET 2 OF 3 |

ORIGINAL

| BCI INTERNATIONAL | DRAWING NO. 20613B2 |
|---|---|
| TITLE: CHARGER/POWER SUPPLY ISOLATED 24VDC OUTPUT/208-252V~ INPUT | DWG. CODE B |
| | SHEET 3 OF 3 |
| | REV. NO. 2 |




Output Plug (#00968)




Wall Plug

III. APPROVED MANUFACTURER:
EDS Model #8826

| Revisions | | |
|---|---|---|
| 1 | SDP 3-1-96 | SEE SHEET 1 C/N 2410 |
| 2 | SDP 3-1-96 | SEE SHEET 2 C/N 4024 |

| DRAWN BY DAU | APPROVALS | | DWG. NO. 20613B2 |
|---|---|---|---|
| ISSUED 1-4-94 | | | SHEET 3 OF 3 |

ORIGINAL

BCI INTERNATIONAL

DWG. NO. 20613B3

CHARGER/POWER SUPPLY ISOLATED
24VDC OUTPUT/90-110V~ INPUT

DWG. CODE B

SHEET 1 OF 2

REV. NO. 2

Revisions

I. SPECIFICATIONS:

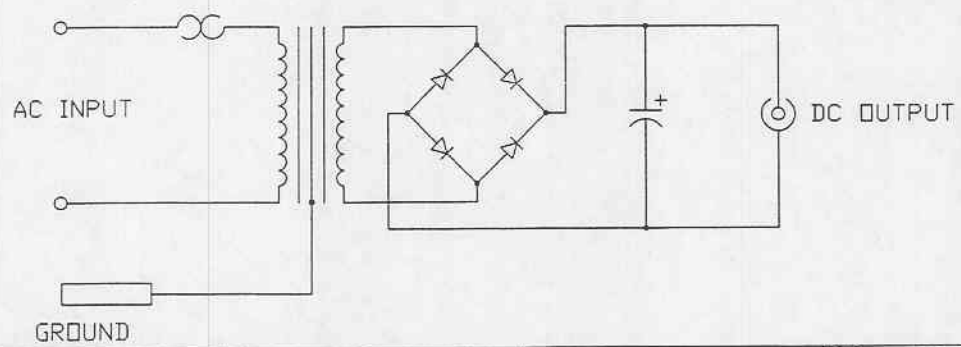
| | | |
|---|---|---|
| A. | Input Voltage | 90-110V~ w/U.S. Standard Ground Pin |
| B. | Frequency | 50 Hz |
| C. | Output Voltage | 24VDC @ 120VAC Input |
| D. | Output Current | 500mA |
| E. | Isolation Requirements | |
| | Primary to ground pin | 1500V RMS |
| | Primary to Secondary | 2500V RMS |
| | Secondary to ground pin | 2500V RMS |
| F. | Output Cord | 20AWG, 6 ft. Lg. with 5.5mm X 2.5mm Plug |
| G. | Construction | Per UL-544 and CSA C22.2 NO. 125 |
| H. | Charger Markings | See Sheet 2 |
| I. | Max. Temperature Rise | 50° C |
| J. | Thermal Cutout | 130° C, UL Rec. Component in series with primary. Elcut #U-23 or equiv. |
| K. | Windings | |
| | Primary | 780 turns of 23 AWG |
| | Secondary | 174 turns of 23 AWG |
| L. | Rectifier | Full Wave Bridge |
| M. | Filter Capacitor | 1000 uF 35V |

N. Fair-Rite core #2643023002 to be molded into place on end of output cordset per dwg.

N. Fair-Rite core #2643023002 to be molded into place on

II. HIPOT TESTING
To be performed on each unit by the manufacturer

A. 4800 VAC primary to secondary, 1 sec.
B. 1500 VAC primary to core, 1 sec.
C. 800 VAC secondary to core, 1 sec.




2 MER 6-11-97 SEE SHEET 2. C/N 4024

| | | | |
|---|---|---|---|
| DRAWN BY DRH | APPROVALS M.S.GEISLER | | DWG. NO. 20613B3 |
| ISSUED 8-17-94 | J.M.PETER 5-26-95 | D.SEIFERT | SHEET 1 OF 2 |

ORIGINAL

BCI INTERNATIONAL

DRAWING NO. 20613B3

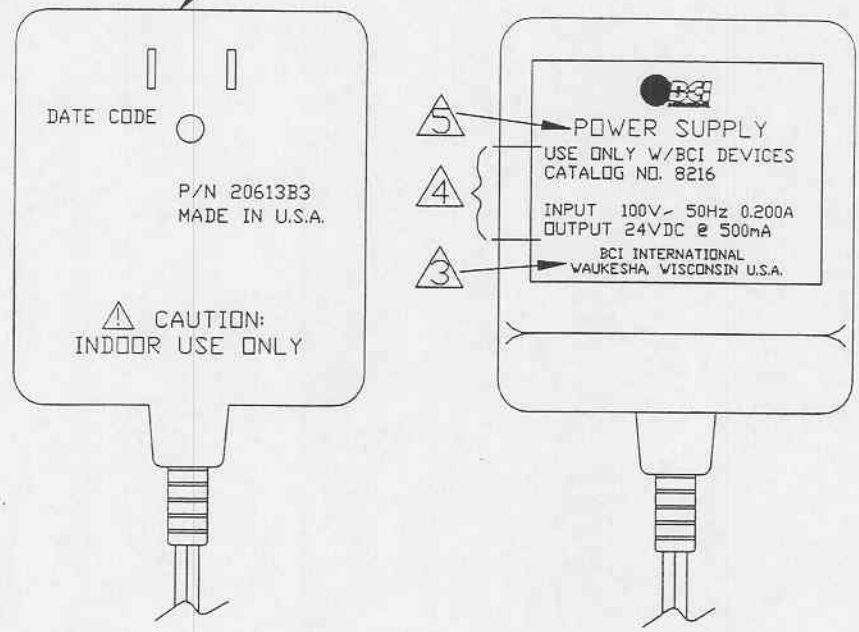
TITLE: CHARGER/POWER SUPPLY ISOLATED 24VDC OUTPUT/90-110V~ INPUT

DWG. CODE: B

SHEET 2 OF 2

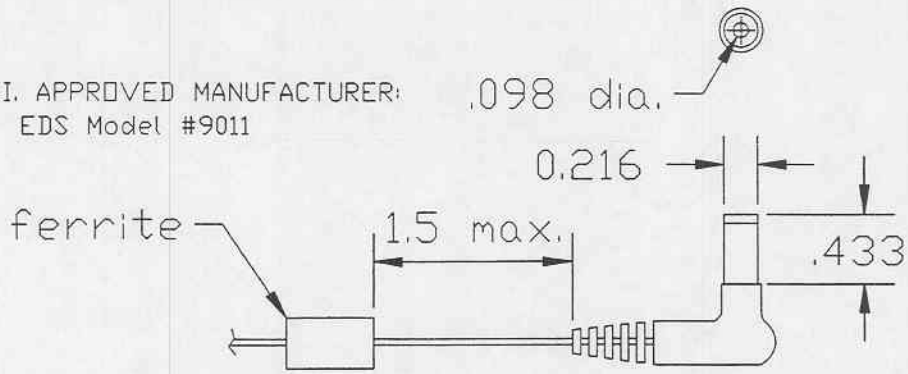
REV. NO. 2

ENCLOSURE SERIES JUMBO




NOTES:
1. CHARGER TO BE HOT STAMPED ON BOTH SIDES WITH INFORMATION SHOWN. INK MUST BE ALCOHOL RESISTANT.
2. CORD TO BE TERMINATED WITH PLUG #00968 SHOWN BELOW.
3. LETTERING TO BE 6PT HELVETICA MEDIUM.
4. LETTERING TO BE 10PT HELVETICA MEDIUM.
5. LETTERING TO BE 14PT HELVETICA MEDIUM.

III. APPROVED MANUFACTURER:
EDS Model #9011




Revisions

| | | |
|---|---|---|
| 2 | MER 6-11-97 | REMOVED LOT NO. BOX & NOTE 2. RENUMBERED NOTES. SEE HISTORY FOR PREVIOUS REV. INFO. C/N 4024 |

DRAWN BY: DRH
DATED: 8-17-94
APPROVALS

DWG. NO. 20613B3
SHEET 2 OF 2

ORIGINAL